The Builder.

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Design for Street Front (Royal Academy Travelling Studentship, 1900).—By Mr. Henry Tanner, A.R.I.B.A. ..... *Double Page Ink-Photo.*
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An Entrance Lodge.—By Mr. H. Inigo Triggs, A.R.I.B.A. ..... *Single Page Ink-Photo.*
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Sun-dials.

IN the *Builder* of December 21, 1889, we published an article on sun-dials, part-suggested by Miss Gatty's re-issue of the book originally brought out by her mother, Mrs. Alfred Gatty, in 1872, when we gave a very simple diagram showing (what many people do not realise) that in whatever position the dial is placed, whether on a vertical wall or on a horizontal surface, the gnomon is a visible portion of an imaginary line parallel with the earth's axis; a fact which, once grasped, does more than anything else to dispel the element of mystery, or puzzle, which the popular mind finds in the sun-dial. Although, as we then observed, the interest in the sun-dial is in the present day a purely æsthetic one, since we have more convenient and exact methods of recording the time, this interest has in the last few years rather increased than diminished, so that we can feel no surprise at being greeted by a third issue of "The Book of Sun-dials"* in a much larger form and with a great deal of additional matter, compiled by the same editors, Mrs. Eden (formerly Miss Gatty) and her friend Miss Lloyd. Not only have a great many new examples with their mottoes been added to the already long and interesting list, but the book has assumed a more important form in a historic and scientific sense.

The information contained in the former general chapters on "Remarkable sun-dials" is now extended and classified in distinct chapters on "Antique dials," "Early English dials," "Early Irish dials," "Renaissance dials," "Scottish dials," and various other classes distinguished not by geographical situation but by peculiarity of design or make. A long chapter has also been contributed by Mr. Lewis Evans on the curious subject of "Portable dials." Mr. Wigham Richardson's short paper on the construction of sun-dials remains pretty much as it was in the 1889 edition, but we observe that he has been able to make use of Sir Norman Lockyer's admirable diagram of the principle of the sun-dial, to which we referred in our former article as one of the simplest and most intelligible graphic explanations of the problem. We observe, however, that the misleading paragraph to which we formerly objected—"the gnomon will be a right-angled triangle &c."—is still retained (page 472), giving the incautious reader the impression that the right-angle is an essential part of the business, whereas it is merely one way of strengthening the gnomon, which might equally be a scalene triangle (if we choose to make it a triangular structure), the only important point being that the hypothenuse of the triangle, which is what actually casts the measuring shadow, should be at the proper angle, viz.: parallel with the earth's axis; while the triangular construction may of course be dispensed with altogether.

In considering the early English dials the authors fully recognise that the fact of a dial being affixed to a building is not evidence of its being of the same age as the building; but there is some question whether the dial at Weaverthorpe has even the date of the building in its favour as giving it a Saxon origin. Professor Baldwin Brown, in his recent series of articles in our columns on Saxon churches, does not admit Weaverthorpe as a proved Saxon example, yet the authors speak of the dial on it as being, by implication, of the middle of the tenth century. The Kirkdale dial, however, is of better authenticity; at all events the church is Saxon. A better illustration of this dial is given than in the 1889 edition. It divides the time on the half-circle into eight parts; the Weaverthorpe dial divides it into twelve parts, which seems in itself an indication of a later date, though there is a considerable similarity in the general design of the two dials; both, in particular, show the device of marking the more important divisions of time by a short cross line over each alternate ray; a method of accentuation found in a good many of the early dials. That at Bishopstone (Sussex), which divides the day into twelve hours, accentuates every third ray in this manner; thus marking the quarters of the day. This dial has been attributed to the seventh century, a date which we should think quite out of the question; nor do the authors support it.

The many curious forms of hollow dials found in among those of Renaissance date, and especially in Scotland, are amply illustrated in the volume before us, but they are mostly more curious than either beautiful or useful, for it can hardly be thought that the same care went to the setting out of these eccentric dials which was bestowed on a simple dial with a flat face, which was really set out to tell the time as exactly as the means allowed. The many-facetted dials for which there was at one time such a fancy in Scotland are for the most part anything but beautiful; they remind one rather of the old-fashioned plum-pudding with pegs of spice sticking out of it like a *chevaux de frise*. The most simple and useful form of dial is also the most pleasing, both in regard to appearance and association.

The chapter on portable dials added to this edition by Mr. Lewis Evans, who has made a collection of these articles (which have been made in numbers and variety quite beyond what would be expected by those who have not made a study of the subject), is a really valuable and most interesting addition. At first thought the idea of a portable sundial seems rather analogous with the practical joke of sending a simpleton out at night to get the time by the sun-dial with a candle; and we should imagine that the adjustment of these portable dials to the circumstances was often very roughly carried out. One of the simplest forms is a very wide ring with a small hole pierced in it, "the hour lines marked by sloping or curved lines drawn across the breadth of the ring inside so as to suit the various seasons." The adjustment was made by simple gravitation, the ring being suspended edgeways by a small staple at one point in the circumference, and the side with the hole in it turned towards the sun. Ring-dials of this description were much used in England, and were made at Sheffield, Mr. Evans tells, as late as 100 years ago. There are however other instruments figured and described by Mr. Evans which are of much more scientific make, and provide for adjustment according to latitude. In the majority of forms the principle of setting seems to

* "The Book of Sun-dials," originally compiled by Mrs. Alfred Gatty, now enlarged and re-edited by H. K. F. Eden and Eleanor Lloyd. (London: Geo. Bell & Sons. 1900.)

Fig. 1.

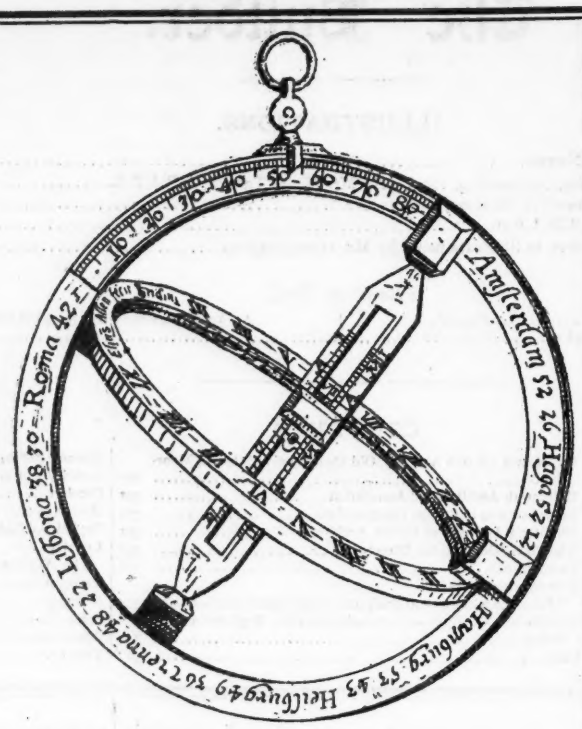


Fig. 2.

have been, as in the ring-dial, by gravity; but there are some later forms capable of more scientific precision of adjustment. On the other hand, in the case of the pretty chalice or cup dial figured on page 190, where the hours are marked on the inside of the chalice and shown by the shadow of a wire gnomon standing up in the centre, no indication is given as to the means of adjustment.

One of the most interesting things figured in this chapter is the Roman dial in Mr. Evans's possession, of the engraving of which we give a reproduction (fig. 1), and which is supposed to date from about A.D. 300. In this the outer circle (about 2⅞ in. diameter) is divided into four quadrants, one of them further divided into sections of 30 deg.; the smaller disc, which turns in the hollow of the outer one, has its surface bisected by a line—the equinoctial line, with divisions on each side of it representing the sun declination north or south on entering each sign of the zodiac; and on one side of the equinoctial line is a line drawn at right angles to it passing through a small knob. The gnomon and the curved piece with the hour lines marked on it are both carried on a pin passing through the dial.

"To use this instrument it was necessary first to set the line with the knob on it opposite the latitude of the place, as shown on the outer disc, and then to adjust the gnomon to the season of the year. In the drawing it is shown set for latitude 52 deg., and for one month from the winter solstice—that is, about the 25th of January or November.

When the dial was thus set it was allowed to hang from a string fastened to the small loop at the top, and turned until the shadow of the gnomon fell exactly along the hour circle, which it would completely cover at noon, and the number of hour spaces not in shadow would show the number of hours before or after noon up to six; for the early morning or late evening hours a modification of the setting was needed."

We give also the illustration of one of the more elaborate of the later English dials (fig. 2), a type which Mr. Evans says, however, was in general use all over Europe in the sixteenth century. In this the outer circle (when in use) represents a meridian circle, the inner one the equator, and the slotted plate in which the gnomon slides, the pole. The gnomon, as in the "ring dial," is a hole which casts a spot of light; it has to be moved up or down in the slot according to the season. The vertical adjustment is by suspension, but apparently the horizontal adjustment could only be by the eye.

This addition to the book, by Mr. Evans, may be the means of drawing a little more attention to a most interesting class of scientific objects, the precursors of the modern watch, of which little is popularly known. In regard to the suggestion that Shakespeare intended one of these contrivances in his reference to the "dial" which Touchstone produces and looks on "with lack-lustre eye," that is no necessary interpretation, as watches had been invented more than a century before, and in an uncleared forest, besides, the sundial would not have much chance of acting; but the point was worth raising.

The artistic side of the subject is hardly professed to be dealt with in the book before us, and there are no illustrations given merely for their artistic interest; but this aspect of sundials cannot of course be overlooked here. Enough has hardly been made of sundials in this sense, either in old or modern examples. The most common form of the old-fashioned garden sundial, placed on a slab supported by a simple pillar or baluster, nearly always looks well, and has the interest of old association about it; but the subject is so suggestive that something more may surely be done with it than this, especially with the aid of sculpture. The wall sundial equally affords occasion for interesting and picturesque symbolical treatment; and a design for a sundial would be a very suitable subject for a students' competition at the Institute of Architects or the Royal Academy. It has been given more than once at the Ecole des Beaux-Arts.

What may be called the literature of the sundial has been much extended in this new volume, which contains a long list of sundials and their mottoes; many of these, as is well known, being exceedingly fine and suggestive; for the marking of time by the movements of the sun (or rather of the earth) itself seems always to have affected men's imagination and moral sense in a manner that the mere mechanism of a watch or clock, made by human hands, does not affect them. The clock can be stopped, the shadow on the dial cannot; we can only watch it and record it; and there is something in that fact that gives a kind of solemnity to this method of measuring time: we see it sliding by, irrevocable. That mankind have felt this is evident from the grave tone of the mottoes frequently found on old sundials especially. It is almost startling to look for the time on a sundial and be brought up suddenly with the reminder "On this moment hangs eternity," or *Suprema multis hora, forsan tibi* ("the last hour to many; perhaps to thyself"). A characteristic French motto, which may be taken either lightly or seriously, is *Il est plus tard que vous croyez*. Then there are the energetic mottoes, urging us to make the most of time; of which one of the most effective, in its weighty brevity, is that from Leventhorpe—"Time can do much." The subject is not inappropriate to our last issue in the century.

STAIRCASE JOINERY.*

STAIRCASING and handrailing are amongst the highest, if not the highest, branches of work in which an intelligent and ambitious joiner hopes and endeavours to excel, presenting as they do opportunity for the exercise of more brain-power and thought than the every-day straightforward operations of the joiner's bench. Belonging, therefore, to the more intellectual side of the craft, the subjects of staircasing and handrailing afford opportunity for treatment of the problems they contain by written and diagrammatic explanation, for whilst it is impossible for a young joiner to learn how to saw straight or shoot truly from a book, it is quite possible to explain clearly the geometrical problems which have to be solved in getting out a wreathed and ramped handrail. It is not, therefore, surprising to find that the vast majority of books intended for the use of workers in wood deal with and are wholly confined to the cognate subjects of staircases and handrailing. Two additions to the number of these books already in existence are now before us, and we are pleased to note that the subjects are therein ably and clearly elucidated. From these we are able to gather what is required to be known by the joiner who desires to possess the ability of a good staircase hand.

In the first place, assuming without saying that he is, of course, already a complete master of his tools, it is very desirable and important that he should be proficient in solid as well as plane geometry. This knowledge, indeed, both our authors assume that their readers possess, and starting from these the novice is first of all instructed in the method of preparing his vertical and horizontal rods on which are marked the rise and going of the stair; and the various rules, some of which are more or less empirical, for determining the proper proportion between the treads and rises are given. The best and most logical of these is probably that which demands

* "A Treatise on Stairbuilding and Handrailing." By William Mowat, M.A., and Alexander Mowat, M.A. (London: George Bell & Sons. 1900.) "Practical Staircase Joinery." Edited by Paul N. Hasluck. (London: Cassell & Company, Limited. 1899.)

that twice the rise added to the tread should equal 23 in. or 24 in., the basis of which rule is that the average pace of an average person is 23 in. or 24 in., and that the labour of stepping up is twice that of stepping along the flat. Other rules, such as the height of a riser plus the tread being made equal to 16 in., or the rise multiplied by the tread equal to 66 in., although giving satisfactory results in many cases, do not apply universally. One early caution given by Mr. Hasluck might be well borne in mind by the young architect as well as the young joiner. "It should also be noted whether stairs, if finished at the bench, can be got into their places in the building, as an error in this direction may give serious trouble." The next operation in the building of a stair is the preparation of pitch board and template, in which accuracy is essential, as from it are marked on the strings the setting out of treads and rises. The preparation of the strings next follows, and full and careful directions are given by our authors, and the method explained of setting-out and working these important parts of staircases. Then comes the housing of treads and risers into the strings and wedging-up; the latter an operation which requires care, as, although unseen when the stair is finished, upon it depends to a large extent the stability of the stair as well as the comfort of the users, and particularly the freedom from creaking, which is in nine cases out of ten due to inaccuracy of wedging, either by faulty workmanship at first or shrinkage of material after the wedging-up has been done. In a small straight-flight stair nothing more remains but to fix a straight length of handrail, it being assumed that the width of the stair is not sufficient to require carriages.

To stairs of more than one flight the framing of outer strings to newels and the construction of winders present additional and more complicated problems, the latter in particular leading to the adjustment of ramps in the strings. A newel staircase with open well-hole is indeed such a long way in advance in point of difficulty beyond a straight-flight stair, that Mr. Hasluck wisely recommends that the novice should construct a model on a scale of, say, 1½ in. to the foot, and we happen to know that this is a course which is very largely followed by those who are endeavouring to obtain certificates of proficiency from the City and Guilds of London Institute.

At the foot of a stair in a restricted space there is usually present a fresh problem, in the treatment of the bottom step, whether this is finished as a mitred step, or a rounded or curtail end; and various ways of forming these are explained by our authors, commencing with the simple square mitred bottom step, and subsequently advancing to the more difficult bull-nosed and curtail, both of which require the ability to construct a riser circular on plan.

For staircases, the method of kerfing is seldom employed in good work, veneering being almost invariably resorted to, the former on account of the small radius of the circles giving an untrue line, and the latter producing a fair surface without unnecessary and undue planing. The veneered ends are, of course, backed with blocks, which it is recommended should be built up.

The next step in advance is the construction of a geometrical stair, where the weakness of the outer strings at the turn necessitates the use of iron balusters and core to the handrail in order to obtain the necessary strength. It is recommended that one in seven of the balusters should be of iron. In geometrical stairs, balanced or dancing steps are strongly to be recommended, thus increasing the number of winders, allowing of a better curve being given to the inclination of the handrail, and the width of tread more closely approximating in the centre of the going to the width of ordinary treads or fliers. We do not find any reference to the continental method frequently adopted with dancing steps modifying the rise, an omission which would seem to indicate a lack of knowledge on the part of British joiners, as certainly the peculiar feeling that one experiences in traversing these continental stairs indicates unfamiliarity on the part of the users.

In the construction of geometrical stairs it sometimes occurs that the normal pattern of cut brackets has to be enlarged or diminished. The method of doing this is clearly explained by Messrs. Mowat. Wreathed strings are also sometimes preferably cut out of the solid instead of being built up or veneered, and to do this forms a suitable introduction to the science of handrailing, as a certain knowledge of solid geometry has to be acquired and utilised. For the purpose of cutting a wreathed string out of a solid plank two moulds are necessary—a face mould to enable vertical faces to be cut out to the cylindrical form which they occupy on plan, and a falling mould to bend round these curved surfaces after they have been formed to mark out the piece for trimming its edges to the requisite falling line. There are two methods of drawing a face mould, first by level ordinates, second by describing ellipses; both of these are clearly explained by Messrs. Mowat. The preparation and application of falling moulds requires a knowledge of the geometrical process for the developments, or, as they may be called in workmen's language, unfoldments of surfaces; these also are clearly treated by our authors.

In both the books we have before us, the construction of stairs for passenger ships is treated, more fully in the larger volume by Messrs. Mowat, but still clearly, though not to so high a development, in the smaller volume by Mr. Hasluck. Much of the ordinary construction of stairs applies also to these special instances, but there are additional points that have to be studied and understood. Primarily amongst these are the modifications of height rods to allow for the sheer and camber of decks. Then also the treatment of treads, by covering them with various materials for minimising wear and tendency to slipperiness, has to be borne in mind. The plans of stairs on board ship often present considerable variation from the more straightforward arrangements usually obtaining in domestic or even public buildings, though in some, particularly those that are termed of quarter-circle type, there occur problems the solution of which is particularly valuable to the joiner who may be called upon to construct some of the independent circular or other geometrically-planned stairs that are occasionally to be seen in high-class shops, which we do not find specifically described in either of our authors.

In handrailing we have what is generally regarded as one of the most difficult branches of the joiner's craft for the workman to acquire, and one, therefore, on which much has been written from the time of Peter Nicholson onwards. Some knowledge of solid geometry is absolutely necessary to the workman who wishes to feel himself adequately equipped for dealing with the problems that handrailing presents. In handrailing one of two systems is generally adopted—either the cylindrical system, including its variations by bevel cut or square cut, and the system by square or normal section. The cylindrical system is that usually practised, and in this the squared wreath is regarded as forming a part of a right hollow cylinder whose base coincides with the plan of the wreath. The surfaces of a squared wreath are of two distinct natures, the vertical sides being quite regular, easily formed, developable; while the surfaces forming the upper and under sides are of a much more complicated character, but in many cases closely approximate to regular helicoidal or screw surfaces.

The system of normal or square sections is more difficult and less extensively practised than the cylindrical method. Both of these systems are faithfully and clearly explained by our authors both in theory and practice. With a view of rendering their volume more complete, Messrs. Mowat have included some chapters on the construction of stone stairs, both straight, circular, and elliptical, in which the modifications of the science of staircasing and handrailing required by the mason are fully treated. There is also an admirable appendix dealing with the ordinary problems of plane and solid geometry which are required by the student. This appendix in particular can be commended to the careful study of young architects and builders, as well as of all those craftsmen for whom it is more immediately intended.

NOTES.

The Easement of Light.

THERE can be no doubt that the tendency of judicial decisions in regard to the easement of light is to make it less onerous. We do not mean by so saying that the right where it clearly exists is prevented from operation, but that the tendency is not to stretch the law against the owner of the servient tenement. In the recent case of the Home and Colonial Stores *v.* Colls, in which Mr. Justice Joyce delivered judgment at the end of the recent law sittings, an attempt was made to obtain a judgment in favour, not of an ordinary, but of an extraordinary, amount of light. But following the decision of Mr. Justice Wright in Warren *v.* Brown, Mr. Justice Joyce refused to grant an injunction. He admitted, as we pointed out when commenting on the decision of Mr. Justice Wright, that the decisions on this point are conflicting, but we are glad to find he took the view which will commend itself most to the opinion of both experts and sensible laymen. We confess that in the case before Mr. Justice Joyce we can see no ground at all for the claim. The light was not required for a special purpose for which much light was needed, such as a jeweller's trade, but for an ordinary office the back portion of which was always artificially lighted. The erection of the new buildings, the Judge found as a fact, would not affect the selling or letting value of the

plaintiffs' premises. This finding, if correct, seems to dispose of the case, because if there were an infringement of the right it was nominal only, and could be only measured by the familiar one farthing. At the same time we should be glad to see Mr. Justice Wright's and Mr. Justice Joyce's modern construction of this point of law approved once for all by the Court of Appeal.

Uses of Expanded Metal.

A PAPER in the current number of the *Journal of the Franklin Institute* deals with the manufacture and some uses of expanded metal. This useful material is obtained by cutting and stretching out sheets of open-hearth steel, so as to form a netting of the desired mesh, or section of strand. The two operations are practically simultaneous, and both are performed in the cold state. Expanded metal occupies a somewhat enviable position, inasmuch as it is a product which has been used to a far greater extent, and for a far greater variety of purposes than the inventor originally anticipated. This is saying a good deal, for we all know how hopeful is the temperament of the average inventor. Perhaps the chief use of expanded metal in the present day is in fire-resisting and in concrete construction. Its suitability in the latter direction is shown by the fact that more than 200 acres of expanded metal were embodied in various buildings at the Paris Exposition. For decorative details in architecture the metal is particularly convenient, and if properly secured to a light steel framing there can be no change of form likely to damage finished plaster surfaces, whilst the excellent key afforded by the mesh gives a sufficient assurance that the plaster will not fall off when once applied. Partitions of plaster upon a basis of expanded metal resist sound waves to a remarkable degree, this property being explained by the theory that the vibrations are intercepted by the network and dissipated in other parts of the structure instead of passing directly through the partition.

Proposed Railway to Hampstead Heath.

THE Hampstead Heath Protection Society have forwarded us a copy of the following resolution, passed at a meeting of their Committee on December 14 :—

"*Charing Cross, Euston, and Hampstead Railway Extension Bill.*

That this Society object strongly to the proposed extension, on the grounds that tunnelling under the Heath may injure it, and that the threatened erection of a station on the summit of the Hampstead Hill, or on or adjacent to any part of the Heath, would be a substantial injury to the Heath.

The Society will use every effort to oppose the proposed extension as shown on the deposited plans."

We have every sympathy with the intentions of the Committee, but it is a pity that they did not confine themselves to the question of the erection of a station on the Heath, as to which there can be no doubt whatever. The statement that tunnelling under the Heath may injure it will be laughed at by engineers. But there is no doubt that half the attraction of Hampstead Heath would be gone if we had a railway station erected there. It seems too bad that we cannot be allowed to keep any place near London quiet from railways.

Fire-resisting Docks.

IN rebuilding the North German-Lloyd docks at Hoboken, N.J., the company is apparently taking precautions against a repetition of the appalling disaster which occurred a few months ago. Along the water front a river-wall of granite and concrete is to be built, and upon this will be constructed a two-story fire-resisting building, 850 ft. long by 130 ft. wide, divided by five transverse fire-walls. The upper floor and a roof promenade are to be reserved for passenger traffic, and those desiring to witness the arrival and departure of vessels will only be allowed to do so from these parts of the dock premises. Each of the three piers projecting into the river is to be formed upon wood piling, protected by a concrete floor decked with timber and sheathed with oak from below water level to the deck, the timber walls being finished with a covering of tin as a further protection. All pier sheds will be of fire-resisting construction, including concrete-covered steel columns, and three transverse fire-walls. Automatic sprinklers and fire-alarms are to be furnished in all the buildings, as well as a complete system of hydrants and fire-hose. Although the piers represent slow-burning, and not fireproof, construction, the method adopted was considered the more suitable, because, as evidenced in the recent fire, steel-work is very liable to be distorted by exposure to great heat. As timber appears to enter largely into the scheme of reconstruction, it is to be hoped that nothing but non-flammable wood will be employed.

The Carnegie Institute.

THE greatest gift of Mr. Andrew Carnegie to Pittsburg is his latest, a technical institute where it is intended that artisans and mechanics may find the means of such education as is most needed in the United States. In announcing his gift, the donor remarked upon his surprise at finding—during a recent visit to England—that nearly half of the students in the Keighley Institute, and fully half of those in the Halifax Institute, were young men and women working during the day and studying various subjects pertaining to their crafts in the evening. We sometimes hear loudly-sung praise of American technical education; but, in truth, this is not generally conducted on lines suited to the wants of self-supporting students, and the remark to which we allude is a sufficient indication of the fact. Too many subjects are included in the curriculum of the American Polytechnic Institute, subjects that might be excellent for the civil engineer, or for the works manager of an important engineering company, but that are not at all necessary to, or desired by, the mechanic. We believe the responsibility for this undesirable state of things lies largely with science teachers whose tendency is towards over-elaboration. If the trustees of the new Institute should be able to secure teachers of the right kind, who will conform with the required standards, the Pittsburg district will derive incalculable benefit from the princely gift of Mr. Carnegie.

Toronto Engineering Society.

A VOLUME published this year records the transactions of the Engineering Society of the School of Practical Science, Toronto, during the session 1899-1900. Amongst the contributions of more especial interest to our readers is one on "Hydraulic and Electric Elevators," giving a fair description of the chief forms of such appliances. In connexion with the direct-connected type of electric lift, it is mentioned that both mechanical and electrical methods are adopted for controlling the motors from the moving car, but detailed reference is only made to a somewhat complicated hand-wheel control. It certainly appears that the more elegant and equally efficient system of electrical control might profitably have been discussed. The safety device selected for description is one consisting of a centrifugal governor actuating a pair of cams, which grip an endless rope connected with another rope wound on a drum secured to the car bottom. On the unwinding of the latter rope, the guides are gripped by two toggle-clamps, operated by right and left hand screws in the drum. This train of movements is rather involved, and presents too many elements of possible failure to be entirely satisfactory. A preferable arrangement is one employed on the Central London Railway, in which the centrifugal governor and the safety mechanism form one self-contained apparatus attached to the car bottom. There are other important features of electric lifts which could have been mentioned with advantage, notably various automatic devices for cutting off current in certain eventualities, and the fact that current can be generated by the motors during the descent of a loaded car, thus effecting considerable reduction in working expenses. It is interesting to observe from a paper on "Roadmaking," by Mr. Campbell, Provincial Road Commissioner, that Canadian roads are now being much improved, both by the central Governments and by the County Councils, and also that mechanical appliances for road-work are coming into more general use in the Dominion.

Stroud Rural and Nailsworth Urban Districts.

DR. ST. GEORGE MIVART'S Report to the Local Government Board on the general sanitary circumstances of the Stroud Rural and Nailsworth Urban Districts states that in the former district, in every parish, almost without exception, may be seen examples of supply by wells and springs, even when the mains of the public water service are available. The only public water service is that furnished by the Stroud Water Company. He saw no wells that had received any internal treatment other than dry steining, usually by means of blocks of local stone, the joints of which were frequently wide apart. There are many wells which are evidently liable to pollution from the direct passage into them of filth from the surface of the ground; the collars and covers being ill-fitting or broken. The only parish furnished with sewerage upon a definitely known plan is Stonehouse, which has a system of sewerage laid in 1884 at a cost of 3,000*l*. The closely-built town of Painswick, above Ordnance Datum, is provided with stone drains of considerable antiquity, in section either square or oblong, with, for the most part, earth bottoms. These drains, now called and used as sewers, were undoubtedly intended originally for the disposal of surface water, but now water-closets in increasing numbers have been directly and indirectly connected with them. At one point he caused a sewer

to be opened; the bottom was found to be covered with several inches of black, stinking sludge, excrement and paper being clearly discernible. These sewers are often only a few inches below the roadway surface. In regard to excrement and refuse disposal, the most striking feature of the district is the common custom of placing privies over the edge of streams and watercourses—wherever such a position is practicable. The Report as to the Nailsworth District gives the same general character as to sanitary conditions.

St. Giles, Cripplegate.

FOR the widening of Fore (formerly Postern) street along its south side will shortly be pulled down a block of seventeenth-century houses, constructed largely of timber, which overlook the churchyard and stand against a portion of the north wall of St. Giles, Cripplegate, Church. The Corporation have purchased the property for, we understand, 19,000*l.*; they will, however, preserve the old gatehouse, opposite Redcross-street, that covers the entrance into the churchyard, and rebuild it in alignment with the new frontage. The quaint old buildings comprise the "Four Shops" and the "Quest House"; they were erected by the parish, and have survived the Great Fire and the recent conflagration in their immediate vicinity. It is proposed after their removal to open out two blocked windows in the north aisle of the church, and to fill them with stained glass in commemoration of the church's escape from fire on those two occasions.

The Latest Thing in Competitions.

AN architect sends us a sample of a circular inviting architects to compete, which may seem, as the phrase is, almost too good to be true; but it is undoubtedly a *bonâ-fide* proposal. It was sent out by a committee wanting a new church at Burghead, and runs as follows:—

"*Proposed New Church and Hall for Burghead.*

MR.——, ARCHITECT,—We, the undersigned, were appointed by the General Committee as a Sub-Committee to procure plans for new church, Burghead, and we shall be pleased if you send us a few specimens you may have on hand of such a building as you think would suit. Our accommodation and finances, which are as follows:—

Accommodation	500
Area	400
Gallery (at end)	100
Finances	£1,300

We would prefer, if possible, a Gothic design. No spire, but instead, two turretettes on principle (*sic*) gable.

Size of hall: To accommodate 200.

As several architects have signified their willingness to supply us with plans free of charge, we have taken your name into consideration."

It would be interesting to know, among other things, what was the latent idea which prompted the reservation, "if possible," before the request for a Gothic design. Probably, however, it was merely meant to imply that the architect might possibly not have a Gothic design in stock at present, as that seems to be the conception on which the whole document is based.

WORKHOUSE, DONCASTER.—Messrs. Shorland & Brother ask us to mention that in this building, described under the head of "General Building News" in our last issue, the warming and ventilation in the wards is carried out by means of their warm-air ventilating stoves with descending smoke flues.

AMERICAN FRAME-HOUSES.*

By HARRY BUDDEN, A.R.I.B.A.

THE printing and figuring on the plan will be noticed (see last issue); this is not put in detail upon the pencilled drawings but on the tracings, and referring to these illustrations, the thoroughness of this on all plans will be admitted, though the system differs nothing from the English. In our examples it was not considered necessary to figure through the whole drawing, so let the left hand in each plan be a type for the remainder. No mention is made in our examples of gas and electric light points nor of bells and speaking tubes, in this they are incomplete, for these are generally indicated at every point, and numbered, sometimes in coloured inks. The doors are figured as they hang, and the custom is to have all doors the same height on each separate floor, though the width varies to suit convenience. Mark all sliding-doors and any glazed ones. The kitchen range stands on a "brick" or "tile hearth" without any chimney breasts to it, and each flue in every stack must be indicated by letter or name. The advisability of this thoroughness throughout a set of drawings may be realised by the English stranger when he learns that the "quantity surveyor" is practically an unknown person in America, and probably the best verdict you will obtain for him if you plead his cause is "time waster" or "expensive luxury." The contractor in America takes his complete set of sun copies and specification for two or three days on a 100,000 dollar job and his subcontractors have every opportunity to obtain particulars from a set in the contractor's room at the architect's office, and so, in a fortnight or three weeks, "bids" can be obtained from eight or ten men, and the results will compare very favourably with any set of English tenders on a similar 20,000*l.* contract, which has taken the quantity surveyor and builders at least two months to figure out.

The cellar walls above ground will be shown in the typical American rubble, and the walls dotted down their full depth. All floor and ceiling lines are clearly shown in red ink, and their heights figured. The windows are also figured, as seen in both these elevations, and the roof and chimney heights, too. The old and new "grades" naturally are required to be shown. A little sketchy effect will be approved in the pencil drawings, but the drawings must be conventional and accurate enough to insure a line tracing such as our illustrations show, though some offices do ask a little freehand on the tracings, and since the sun copies are mostly "blue-prints," and are seldom coloured, this must surely be acceptable to the builder. The little colouring on the prints is done by special coloured crayons such as we will use later in preparing the full-size details. Sections are perhaps not such a feature in a set of drawings for a frame house as would be the case in England; construction is seldom shown on them, because this is all clear on the "frame" tracings.

The "frame plans," though a novelty, will not puzzle one who can see through floor boards and plaster finish to the skeleton of an ordinary wooden construction, though it would do him good to see an experienced "construction man" run off a set of frame tracings on cloth from the original pencil drawings.

For the first floor frame shown here, an outline in red ink (shown dotted) of the cellar walls and piers must first be traced on the cloth, and this pinned down over the first floor plan, then, with the outside of studs as boundary, draw the 6 in. by 8 in. sill round all outside walls, reducing to 4 in. by 6 in. round chimnies. The cross walls are carried on beams, or more often on steel channels ruled in blue ink and figured as shown under the principal interior walls in question. The levels of all such steel or wood girders are figured at once as required within or under the 12 in. joists. The trimmers to stairs, hearths, &c., will next be drawn and figured 6 in. by 12 in. and 4 in. by 12 in., as shown—large scantlings are common—and the floor joists filled in between these at 12 in. to 16 in. centres. The standard joist is 2 in. by 12 in., and it is no economy to reduce it for small areas of short spans here and there. The value of good cross-bridging is acknowledged, and it is introduced in all floors, clearly shown and marked "bridging."

Some offices prefer the cellar outline shown in black and all the timber in yellow ink, but this is easily discovered by reference to previous frame drawings. Where a short cross wall runs parallel with the joists it is usual to carry it on short 4 in. by $\frac{3}{8}$ in. iron plates, lag-screwed to the underside of the two adjoining joists, and these plates must be shown in blue ink. This construction is adopted only for walls carrying no weight, being more economic than using 6 in. by 12 in. trimmer to take the studs, and a separate joist each side to take the floorboards.

The front elevation framing (see lithograph) will present but few difficulties when studied with the elevation itself (given in last issue); adjoining, like the plans, it is prepared on cloth pinned over the original pencil drawing. The sill, girt, and plate previously drawn on the frame plans are set at the required heights, and are held at all angles by 4 in. by 6 in. or 4 in. by 8 in. posts, and in good work have 4 in. by 6 in. braces at feet; then will the outline of window openings be traced on and second lines run round outside these to indicate the "double" studs called for in the specification, which runs as follows:—"Studs to be 2 in. by 4 in. spruce set over each other on 12-in. centres (more often 14 in. or 16 in., in keeping with the joists) and doubled to all openings, to be once bridged with 3 in. by 2 in. bridging and long braces to be used where possible." It would no doubt be better to have window frames 4 in. by 4 in., but the doubling system serves the purpose and is cheaper, because timber of a size can be bought in large quantities. No mention is made of mortice and tenon, simply because experience has proved these to be unnecessary, and so much time and expense is saved, though it will take the Englishman long to believe the omission anything but a "scamping" trick.

The general details for the frame house are invariably prepared to full size in pencil, and the colouring of sections done by hatching with special architect's crayons of excellent quality, better suited than colour wash to the thin roll paper used for detailing and also for the tracing paper they are copied on. Some men even use these colour pencils for the outline, and that again saves time. The colours adopted for various materials differ nothing from our system; yellow for deal, red for brick, green for plaster, blue for iron, and so on. The first and principal detail is a section through an outside wall from cellar window sill to eaves. This is prepared to full size and in a continuous line from bottom to top. The "lower floor" is always carried through to the outside face of studs, a furring strip being introduced to give nailing, but this floor is not always laid diagonally, because the joints of upper and lower flooring running parallel is considered no disadvantage when paper or felt is inserted between the two floors. The underside of all joists taking lath and plaster ceilings is furred with 2½ in. by ⅞ in. spruce on 12 in. or 14 in. centres, and where double plastering on walls is adopted (see detail). Similar furrings are used between the two thicknesses to give nailing to the second laths.

The time-saving instinct of the American has probably developed that method of framing used in Ohio and on West which is shown at B in the detail sheet (see lithograph) and which I think has decided advantages of its own. The "ledger board" seems weak, yet it is sound construction, let in as it is and with joists well spiked to the studs, which can now be cut to one long length and run up at a great rate, whilst the shrinkage in a well dried 6 in. by 1 in. or 7 in. by 1 in. ledger board is less likely to affect the structure than in a bulky 4 in. by 8 in. girt on which all the upper studs rest, and remembering there are no tenons or mortices, the double butt joint cannot be so firm as the through studs. This ledger board construction is sometimes combined with the Eastern method to take the third floor joists when a large attic is desired, and then the top plate standing some few feet higher lifts the whole roof well up from the floor as shown at C in the same detail. The English mind may to some extent be reconciled to the omission of tenons throughout the framing, when, in good work, the "ironing" of plates and posts and heads with 2 in. by ½ in. straps is seen together with efficient spiking, and the bracing value of the outside boarding is considerable, though seldom if ever calculated upon.

Another sketch on the same sheet shows the "hanger," which is the American substitute for our tusk tenon; the iron strap is 2 in. by ½ in., hooked over the trimmer an inch or more and twisted as shown to form a stirrup for the

* Concluded from last issue.

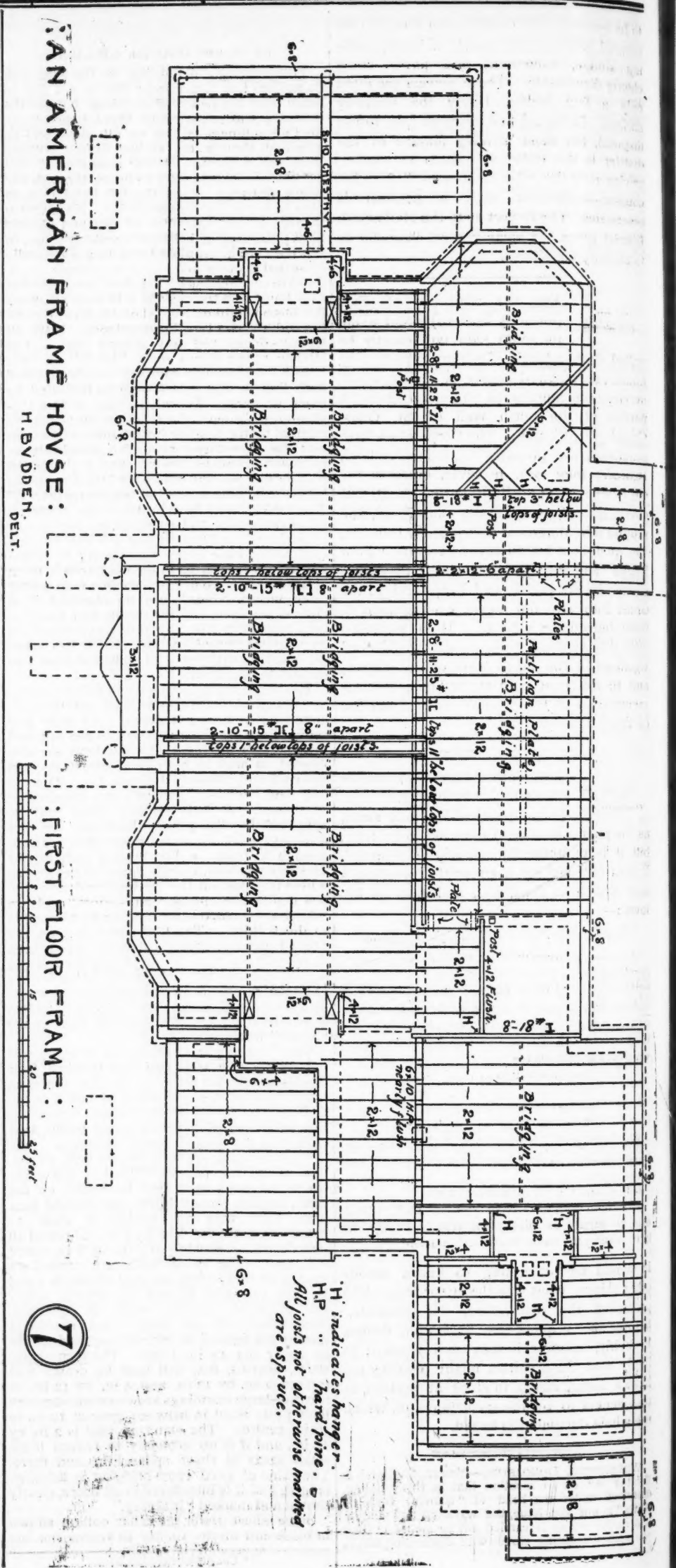
header which is often further secured to the trimmer by a ¾ in. bolt and nut. The common joists are tenoned into the headers in the ordinary way. The lower sketch on this detail explains the carrying of the short end wall to coat closet, running parallel to the joists, on short iron plates where indicated on our first floor frame; these are secured to the underside of joists by ¾-in. lag-screws 4 in. long, and the studs rest directly upon these plates. It is argued that this construction saves the partition in case of shrinkage of the joists, which would not be the case were the iron plates let in on the upper side of the joists, but this is surely a hair-splitting scarcely consistent throughout the job. The furring strips here, as in many another instance, keep the laths well clear on the iron work.

There exists with some architects an old custom called "fire-proofing" or "brick-filling" which it is advisable to know the meaning of in case you are told to "fire-proof all walls and partitions" or "walls only." It consists of filling between the studs with 4-in. brick or terra-cotta lumber in mortar from sill to 6 in. above floor and in partitions from head to the same height, and perhaps again from plate to under side of roof boarding. An example is shown at A on first lithograph; and where this idea is adopted the lower floor is specified to run to brick-filling. The reasons for this construction are so vague and varied, that I will not attempt to explain it, but leave the subject as my inquiries were generally left, with an indefinite reply of "stops run of fire;" "and run of rats and mice;" "makes all a bit solid;" and "helps to hold her down."

The detailed section of the wall from ground to eaves is that first required; it is prepared to full size in pencil—probably coloured pencils—and on a continuous sheet, each part lining up with that below and separated by ruled spaces between the several features; hence this drawing often assumes large proportions, and may have to be "continued in our next" before it reaches the eaves. The cellar window usually has a solid frame, worth remarking because box-frames are by far the most common throughout the States; the granite sill is set just clear of grade, and is shouldered to jambs and throated to projection only in the best work, the common sill being a mere weathered "slip" without projections. The wooden sill is simplicity itself. The weather to all sills in America is obtained in the easiest way possible, viz., by tilting; and the outside face being planed vertical thrusts a sharp angle down on the stone; the under side is pointed in cement from behind to keep it watertight. The cellar is seldom more than our idea of heating chamber, coals, and laundry, but should there be kitchen or servants' hall therein, the walls to these are invariably "furred" with 3-in. by 2-in. studs, and plastered or sheathed with vertical boarding in narrow widths. The rebating of casements is a weak point, since they prefer to open cellar casements inwards; the frame is 5 in. or 6 in. by 2 in., double rebated for casement and for mosquito net frame, which feature may have to be provided for throughout.

The outside boarding is rough 8 in. by ⅞ in., tongued and grooved, and the lower flooring 6 in. or 8 in. by ⅞ in. matched. Both are laid with stout paper before the finish work is applied, so also is the roof boarding, and the paper or felt is turned up behind the skirting, which is fixed before the upper floor is laid, so preventing that shrinkage so often showing between our floors and skirtings. The upper floor is always in narrow widths, tongued and grooved, and in the best rooms blind-naile. It may be 2½-in. by 1-in. oak or hard pine, or for chambers 3-in. spruce, and heavy "deafening paper" or felt is laid between the two floors as just described. The common "clap-board" (weather-board) is 6 in. wide, ½ in. or ⅝ in. thick at butt, and reduces to ⅛ in. It is laid to weather 4 in., and at the angles the best effec is obtained by careful mitreing, though the old angle piece is often adopted. A narrow strip of tin-flashing is inserted where clap-boards and architraves abut, tin taking the place o lead in all such instances, and if painted both sides before being fixed, it has a life long enough to warrant its adoption. Mosquito frames are incidentals which may be asked for or not, the usual practice being only to prepare a place should the proprietor adopt them afterwards.

Frequently a design breaks from clap-boarding to shingling above the first floor or



in the gables; then the detail of this would be shown in its place on the drawing between the first and second floor windows.

The eaves treatment is, perhaps, the most varying feature of the frame house. The "Colonial" house will almost invariably carry something pertaining to an entablature at its eaves, and the section will show if it is to be supported by projecting joists, rafters, or sprocket-pieces. This point settled and the material for gutter—wood or metal—decided upon, the wooden casing to any detail is easily applied. The characteristic part is about the gutter itself. This is a stock design in white pine, though many wisely prefer red wood—"Sequoia," as it is termed in England—a fancy name, perhaps to command a fancy price, for it is a cheap pine in the West. The groove for the facia under is run as required on the job to suit detail. A 1-in. gutter facia notched over the back of the gutter takes the edge of the shingles. The back facia adds stiffness to the whole, and covers any defect in the joint between gutter and its facia. The "planceer" or soffit is always tilted, so that, should there be any overflow caused by snow or ice accumulating on the outer edge, it will not flow back to the wall, but escape through holes purposely bored in the width between the brackets. The gutter is painted inside as out, joints are made in red lead and tinned over. The eaves to porch or piazza, such as is shown in the general elevation published last week, will be on the same lines and could be detailed in the same way, but with another and smaller stock gutter. The piazza ceiling would be sheathed in narrow widths, 3 in. by ¾ in. or ½ in., tongued and grooved and beaded, with a small angle mould as indicated. It might be well here to refer to the piazza column, as it would be detailed at the same time to inch scale or quarter full size with upper or lower diameters to full size. If the diameter is only about 12 in., the column will be built up solid out of 3-in. or 4-in. planks and turned on a lathe, but if larger than this, as the column to portico in the front elevation, they would be built up hollow and the joints hidden in the fluttings, and one will look at many such columns before he finds the joint. They stand the climate wonderfully; so does the cap, because this is papier-maché and a stock design, yet manufactured by a maker who has employed excellent modellers. And so "Cap No. 2,785 to 10 in. diameter" is detail enough; and when all is painted from gutter to base in the typical American white the effect is good. The weight over such a framed column as that to our portico would be taken by a 6-in. by 6-in. or larger hard pine post which occupies the centre space.

Returning to the subject of eaves, that to the main house shown in our working drawings requires a very different treatment from the "Colonial" one we began with; yet it will be found familiar enough to houses wearing an expression that some might term "Italian." The soffit in this case would be panelled or lined with narrow sheathing; cut brackets, about 4 in. wide, are simply nailed on, and the bed mould cut in between them; the facia and mould complete the "finish," while the gutter is a 16-oz. copper one, or 20-gauge half-round galvanised iron, hung clear of eaves with galvanised iron rods, 1 in. by ¼ in., and dogs 2 ft. on centres. Such an eaves will often have a projection of some 3 ft. or 4 ft., and be treated exactly as those old Florentine loggias with very deep shaped rafters and coloured panels in the soffit, and, by the way, being told to adopt such an Italian detail for this or any other feature, you will do well to copy it implicitly. It is deemed no crime to transplant from Italy through book or photograph a complete detail to America, where many such thrive; they are as familiar parasites on many a fine healthy design, and one can only admit that a good copy is better than a bad original in such matters.

The dormer details would not trouble the Englishman much, he is acquainted with the feature on old places like Clare College; and the "Colonial" house would have as good if it could, but the too general use of hung sashes instead of casements robs a dormer of a valuable effect, though a good overhang to the eaves compensates this loss not a little. A dormer in the picturesque American treatment may call for almost any variety of finish, with or without barge-boards, but in the familiar shingle treatment the projection amounts to nothing and the finish is kept very simple. The "Gambol Roof," so familiar in small houses with attic story, is often laid to a dangerously flat pitch for shingles, rendered water-tight only by layers of tarred paper, &c.

The appearance of frame houses is enhanced not a little by the colours they are finished in, whether stain or paint; and though that does not affect the mere drafting, it is worth remembering that the majority have stained shingles, green for choice, and buff or brown painted clap-boards, whilst all "finish" from gambol roof to water table is painted white, and probably varnished. The interior finish of the frame house can claim nothing really peculiar to it, and therefore can scarcely have a place under this heading.

ARCHITECTURAL ASSOCIATION DISCUSSION SECTION.

THE fifth meeting for the session of the Discussion Section was held on Friday evening, the 14th inst., at 56, Great Marlborough Street, W., Mr. C. H. Strange in the chair, when Mr. Crawfurth Smith contributed the following paper which he himself, now holding an appointment in Ireland, was unable to read, and which Mr. George H. Smith, Hon. Secretary, read on his behalf. As the subject is one seldom treated, and of some interest, we give the paper entire:—

The Churchyard and its Accessories.

"In dealing with the subject of my paper, I wish to confine myself strictly to the churchyard as an intrinsic part of the church it surrounds, and therefore interesting to the architect, it being, I think, a very good axiom that a country church is largely what the churchyard makes it, it being the setting, so to speak, of the jewel. Under these circumstances, the subject of cemeteries will not be considered.

Before going into detail we may briefly note that from the time of the Cave of Macpelah, amongst Jews and Christians, and from the earliest records of other nations, places of sepulture have always been set apart and regarded with feelings of respect and veneration. Amongst those nations who practised cremation in some form or other the place of the deposit of the ashes has been equally respected, witness the Roman Lararium. In the history of the Catholic Church, we find that about the year 750 A.D. spaces of ground adjoining churches were enclosed and consecrated for burial, and by a canon of the ninth century every grave was to be esteemed sacred, to be adorned with the sign of the cross, and was to be preserved from trespass and violation by dogs and cattle. It is needless to refer to the ceremony of consecration performed by the Bishop in all branches of the Catholic Church to bear witness to this respect at the present day.

Many churchyards have a history far older than the church which stands in them, being places appropriated to religious assemblies, divine service being performed, and so the church was added for greater honour and convenience.

It is a curious fact that in a large majority of cases the churchyards are on the north side of the church and on the north side of the road leading to them. St. Leonards, Aldrington, Sussex, has this peculiarity and also Sompting Church in the same county. There is also a superstition amongst old-fashioned peasantry that the north side of the churchyard is less sacred than the rest of the consecrated ground. It is often found in country churchyards that the north side is unoccupied by graves where there is space in other portions available. 'To be buried there' says Durandus, the great fourteenth century ecclesiologist, 'is, in the language of the eastern counties, to be buried out of sanctuary,' and the position is appropriated to the graves of suicides, unbaptized persons, and excommunicates. Incidentally I may remark that in the 'Paradise Lost' Milton in every case refers to Satan's Palace in the Heavenly Country as being in the 'Regions of the North.' There is doubtless some connexion between the two, though an obscure one. It must of course be borne in mind that local peculiarities of site would be the first factor to be considered in the disposition of the churchyard.

The churchyard may be for the purposes of our discussion considered from three aspects: 1. Religious; 2. Practical; 3. Æsthetic. This is not the occasion on which to deal with the first. As regards the second, although it is subsidiary in importance from our point of view, yet certain facts must be considered. They are briefly:—1. Soil. 2. Size and disposition of graves. 3. Convenience for burial service and general particulars as to laying out.

First as regards the soil, of course this must to a large extent be guided by the neighbourhood and locality. I may point out, by the way, that under the Public Health Act a cemetery must not be constructed within 200 yards of any dwelling house without the consent in writing of the owner, occupier, or lessee. This I presume would apply equally to a churchyard although surrounding a church which had been in existence for many years.

The soil should be dry, close, and yet porous, permitting the rain and its accompanying air to enter and so expedite decay. The formation should be well covered with vegetable mould which assists in neutralising any noxious exhalations, and encourages the growth of shrubs. The subsoil should be of such a kind as will readily drain itself and so prevent water lodging in any grave or vault. It should also be exposed to north or north-east winds, which are dry and do not hold the putrative gases in solution like the moist south or south-east winds; against this graves open to the north, and sheltered on the other sides are sunless which has a most depressing effect. Loam, sand, and chalk make the best soils, clay and stony ground if not finely commingled the worst.

With regard to the number of graves in a churchyard, a standard of 110 to the acre is often taken; this of course permits of a large number of burials, as more than one coffin is often laid in the same grave. It may be roughly estimated that one-sixth, at least, of the total available space is taken up by paths, shrubs, &c.

I may add, that in order to make the best of an old churchyard in a bad soil, deep and careful drainage should be adopted without hesitation; drainage pipes laid at a depth of at least 10 ft., and the positions carefully marked for obvious reasons. Surface drainage of the paths should always be provided; nothing is worse for the church, churchyard, or monuments than water-logged paths and standing pools. A rough garden enclosed should, as far as possible, be provided in a position as close as possible, as there is always a large amount of surplus earth remaining after a newly-dug grave has been filled.

It is of the highest importance that a careful plan of every churchyard, showing the grave spaces, should be kept and adhered to, and for old churchyards such a plan should always be made; neglect in this particular has often led to very horrible results. Many old churches have suffered from vaults being dug right under walls or so close to walls or buttresses that a subsidence has occurred, repairing which has led to much trouble and expense. I had to take down the whole of the tower of a small Kentish church and rebuild it, owing to the fact that one of the angle buttresses was undermined by a family vault. A large border of lawn or a path round the church is better for the foundations and adds greatly to the appearance. Under the Cemeteries Act in new buildings, a space of 15 ft. is reserved round the building. The sizes of grave spaces vary for adults from 9 ft. by 4 ft. to 9 ft. by 6 ft.; the direction, it is needless to say, is always east and west. The foregoing details may appear prosaic, but bear upon the subject of my paper.

The æsthetic aspect of a churchyard appeals, and has appealed, to us all. The immortal 'Elegy' presents a picture with which we are all familiar, and which needs nothing more to enhance it.

May I state as a fundamental proposition that a really picturesque churchyard is beyond our power to design; the quiet plot of ground with varied alterations of light and shade, the sea of grass heaving in the soft undulations of nameless graves, broken by a moss-diapered cross, or quaintly carved headstone, the churchyard cross rising from a low stepped pedestal, and the whole curtained with sombre trees, owes all the beauty it possesses rather to the genial irregularity of its growth than to the skilled hand of the artist. However, having the ideal before us, we may all do our best to attain to it.

I think we shall all agree that the best covering for a churchyard is turf, the paths, where required, being of gravel. I have seen a churchyard, I think St. Peter's, Bournemouth, where the graves were laid out each with a surrounding of path and shrubs, and the result was, to my mind, not happy.

On the importance of keeping the turf constantly cut and free from leaves I need not insist.

Walls.—What is the best wall for a churchyard? The modern cemetery with its dwarf wall and iron railing is a thing abhorrent; no doubt the most successful wall is a rubble wall with rounded top and moss grown, but this unfortunately is grown, not made. A stone wall in rubble with a red brick coping soon acquires a pleasant weathered look; the wall should, I think, be as irregular as is compatible with proper enclosure. Stone or coursed rubble or red brick with a weathered coping with rough battlemented top looks very well, and I should like to put in a word for the use of buttresses to the wall, not too wide with one offset. I have in my mind a granite wall in rough coursed rubble, with hit-and-miss coping and red brick buttresses at intervals, and overgrown here and there with creepers; the effect is very pretty; they break the long stretch of wall surface and add greatly to the picturesque appearance. One of the pretty country churches I know has next to no wall. It lies about 5 ft. above the road level, with a rubble retaining-wall with ferns here and there, and has a low stone coping about 2 ft. high; but this unfortunately is not always feasible.

Trees.—Having decided upon our walls, the next question is laying out the ground in the most picturesque form. Graves being laid from east to west, paths should, as far as possible, run at right angles to the general line of graves, in order to avoid too tidy an appearance. The graves should also be placed at reasonable distances apart, so that a person may pass to any particular grave without treading upon one adjoining; and this is a matter that is often neglected, probably with a view to burying as many as possible within a limited area—I should hardly like to suggest for the sake of making a maximum sum of money—The path should be plain gravel rolled, of sufficient width to allow a funeral procession, no more, and with grass only at the edges; tiles or iron rails are both inconvenient, unsightly, and give an artificial appearance which is out of place.

With regard to the question of planting a churchyard, much depends upon the situation, locality and surroundings. We are all familiar with the traditional avenue of yews leading to the church porch, or the large tree spreading far and wide over the surrounding graves; and no one will question the fact that from its sombre colour and massed foliage it is very suitable; besides long traditional usage has strengthened its position, but brighter foliage, shrubs and trees are not out of place. Trees like beech and sycamore, which shed their leaves in great profusion, should be avoided for obvious reasons.

For my own part, I think the traditional avenue from gate to porch should be avoided; it is inconvenient for funerals, it cuts a hard line through the churchyard, and prevents cross views. A clump should be placed each side of the lych gate at entry, and in each corner where an angle occurs, or where the churchyard is overlooked too closely. As regards the planting of the churchyard, circumstances and individual tastes enter so much into the matter that I do not feel called upon to make any remarks.

Tombstones and Monuments.—These are unfortunately in many cases entirely beyond the power of the architect to control. In the majority of cases the monumental mason supplies the sorrowing wants of the mourners with graven blocks that add a new pang and indignity to death; if his talent could be restrained to a simple cross with either plain or carved surface it would be endurable, but he ranges from slabs having the appearance of chairbacks in stone to angels whose simper would be out of place in a domestic servant, and the contour of whose limbs is cursed with a commonplace immortality. I have even seen a country churchyard which was as beautiful as natural advantages could make it, vulgarised by the monument to a member of the local squire's family with a cabinet photograph of the deceased let into one side and protected with glass. Wreaths of artificial flowers can be treated with the contempt they deserve.

To my mind the more simple a grave is the better; a low mound covered with turf, at the head an oak cross made of oak 2½ in. thick, the members 6 in. wide, standing about 4 ft. high, and finished by a weathered canopy extending from the head to the extremities of the cross arms, and crowned with a small triple roll is as complete and picturesque a monument as can be desired; there is ample room for the name, date, and whatever else in truth and reason may be required; the material is lasting, in harmony both as to design and substance with its surroundings, and the weather and lichen soon give the surface an exquisite enamelling. I would also call your attention to many of the tombs of the neglected eighteenth century. They, as a rule, may be arranged in two classes, headstones and tombs of the coffer order, the outline of the former are often very elegant, and the latter are really in many cases models of refined design; there is an excellent example of this latter in New Shoreham churchyard, Sussex.

How far the debased copies of classical models seen in many churchyards can be regarded as either picturesque or appropriate, I leave you to consider. The representation of a broken column is not in itself an object of beauty, and from a Christian point of view has no sense of fitness.

Churchyard Cross.—This appears to have been an important adjunct from the early ages of Christianity.

The Emperor Justinian made a law (probably legalising an existing custom) 'that none shall presume to erect a church until the bishop of the diocese hath first been acquainted therewith, and shall come and lift up his hands to heaven, and consecrate the place to God by prayer, and erect the symbol of our salvation, the venerable and truly precious rood' (Sir R. Phillimore, 'Eccl. Law,' p. 1761). Accordingly, the service for the consecration of a churchyard, in the old Pontificals, involves the existence of a cross, though from the pictorial illustrations it would seem as if the cross were sometimes only a temporary erection of wood.

An Irish canon of the eighth century, published by D'Achery, seems to indicate their meaning; it directs that a cross shall be set up wherever there is a consecrated ground to mark the limits as well as the sanctity of the place.

One of the constitutions of William of Blois, Bishop of Winchester, made in 1299, says: 'Let a handsome cross be erected in every churchyard, to which the procession shall be made on Palm Sunday.'

An incident recorded in the 'Life of Mr. Richard Baxter' (p. 40 of the folio of 1696) gives a graphic account of the way in which their destruction was often effected, and of the opposition which was sometimes offered to it by the better affected:—

'About this time (*i.e.*, 1640) the Parliament sent down an order for the demolishing of all statues and images of any of the Three Persons of the Blessed Trinity, or of the Virgin Mary, which should be found in churches or on the crosses in the churchyards. My judgment was for obeying the order, thinking it came from just authority, but I meddled not in it, but left the churchwarden to do what he thought good. The churchwarden (an honest, sober, quiet man), seeing a crucifix upon the cross in the churchyard, set up a ladder to have reached it, but it proved too short. Whilst he was gone to seek another, a crew of the drunken, riotous party of the town (poor journeymen and servants) took the alarm, and ran together with weapons to defend the crucifix and the church images, of which there were divers left since the time of Popery.' On the other hand, where the Church party had the upper hand, the churchyard crosses which had been mutilated or fallen into decay were at this period sometimes repaired. Blomfield (Norfolk, i., 362) relates how in 1632 the wooden top of the cross in the churchyard was made by appointment of the Bishop of Norwich. On the top of the side towards the church was painted 'Crux Christi salus mundi'; on the standing part, 'Christus pro nobis passus' on the traverse a wounded heart, and hands wounded with nails, 'Ecce! quanta pro te pertulit'; on the back side, towards the east, 'In Christo spero'; on the standing part, 'Si compatemur conregnabimus'; then on the traverse, 'Reliquit nobis exemplum.' The globe was set up to signify the heavens, coloured with blue, with stars and clouds; on the equator circle, 'Aspiremus permansura eterna'; the lower part coloured green to signify the earth, with trees and flower, on it 'Quid tumultuamur et peritura possidemus.'

If the crosses which remain be studied it will be seen that they divide themselves into two classes, of very different style of design, which may be called pre-Gothic and Gothic. The former are usually richly decorated as beautiful ornaments of the court of the sanctuary and appropriate monuments to the undistinguished dead whose dust lies thick around.

The churchyard crosses of Ireland form in themselves a subject of unique interest, and from their design and form are suitable as models for reproduction in England. I have a few photographs of some of the better known crosses. Generally speaking, these crosses were erected for sanctuary or commemorative purposes; in very exceptional circumstances only were standing crosses sepulchral, as appears from a homily on the life of St. Patrick. The sepulchral crosses were generally cut on incised slabs. Of these latter many examples remain both in England and Ireland. The simplest form is generally a Latin cross floriated at the top and cross ends, and having a circle round the crossing or quatrefoil, the cusps of which are also floriated. It was customary on choosing a site for a church or monastery both to indicate and hallow the site by the erection of a cross; thus from the Book of Lismore we learn that St. Columba, when he founded a church where Swords now stands, 'marked out the well named "sord,"' *i.e.*, pure and sained a cross.

The form of the Irish crosses is in nearly every case almost the same, a Latin cross having a circle round the crossing erected upon a stone base, the material granite or freestone, and the inscribed ornament the Crucifixion, the Twelve Apostles and other Scriptural worthies, and representations of sacred scenes or emblems. The base and remaining surfaces are covered with that implicated work common to all Scandinavian carving. Most of the crosses had originally a roofing stone, but this has generally disappeared.

The following is a detailed description of one of the high crosses at Castledermot Monastery, county Kildare. The date of the cross is slightly earlier than 900 A.D.:—Castledermot North Cross—Height, 10 ft. 3 in.; 3ft. 10 in. across the face; shaft, 16 in. across face, 11 in. thick. The plinth is 3 ft. high by 2 ft. 8 in. at base, and has two panels on each face. The face of the cross is divided into seven panels. The whole cross is carved out of one stone. The roofing stone, probably about 18 in. high, is lost. The centre panel at the crossing has on one side 'The Fall,' and on the other its expiation (for the carving on these crosses was always highly symbolical), the Crucifixion. The four panels round the centre, starting from the top, are: Top, Martyrdom of St. Peter; right, David with a harp; bottom, Daniel in the lions' den; left, Sacrifice of Isaac. The two remaining panels in the shaft have three figures in each. The reverse has three figures in the four panels of the head, making up the Twelve Apostles; and in the shaft, Abraham receiving gifts from Melchizedech denoted by the chalice and paten carved between the two figures, and the bottom panel has two figures unknown.

The base has on one side a sitting figure, swathed, clasping its knees; this is very curious, and is used to signify death. The bodies found on opening many cromlechs are swathed and in the same position. The reverse has the miracle of the Loaves and Fishes. The remaining panels and spaces are carved with the implicated ornament mentioned above.

Lich-gate (from Anglo-Saxon *lich*, a corpse), a churchyard gate with a roof over it, under which, on the occasion of a funeral, the corpse and its bearers may await the coming of the officiating minister. They are sometimes of stone—as at Birstall, Yorks—but more frequently of timber, and form a picturesque and suitable entry to the churchyard.

Some of these gates have chambers over them, as at Barking, Essex, where the one chamber was formerly called the Chapel of the Holy Rood; and at Bray, Berks, where the two chambers are connected with some charitable bequest. At Tawstock, Devon, there is a small room on each side of the gate, having seats on three sides and a table in the middle.

There is also sometimes, especially in Cornwall, at the churchyard-gate a great stone, called the Lich stone, on which the coffin can be placed while the funeral procession is waiting, as at St. Winnow, Cornwall. Such stones are sometimes found at a distance from the churchyard as a resting-place for the coffin on its way to burial, as at Lustleigh, Devon.

With regard to the design of lich-gates, so many different examples must be familiar to you that I will not do more than make a few suggestions. They should be simple, consist of three entries, two side gates and one large gate for the entry of hearse, &c., sufficiently lofty, and the roof timbers open and not

covered in any way. It is seemly to erect a cross over the centre, and the beams facing both ways may be painted with suitable inscriptions in red or black. Oak is the most suitable material for the framing, simply oiled to resist the weather, on a stone or brick base, and covered with tiles or slates or small stone slates as the locality affords. I have never seen them used, but would suggest oak shingles for a covering. They take a pleasant tone from the weather and are durable.

Finally, I hope this paper will give rise to an interesting discussion on a matter that is considered comparatively little by architects, and I have therefore made my paper short, giving rather suggestions than a set treatise. Let us bear in mind that the greatest and best rule for success is simplicity, and giving Nature, as far as possible, a free hand within proper and conveniently arranged limits."

Mr. F. C. Eden proposed a vote of thanks to the author. Coming to the paper in detail, he thought that too many paths in a churchyard were undesirable, breaking up the appearance of repose, and that beside the gravel mentioned in the paper, in some districts stone flagging and stone pitching were available and might be used, and he rather favoured the old-fashioned cobble paving, which enabled one always to have a dry path to walk on; asphalt, however, he deprecated. The enclosure to a churchyard—a low wall, 4 ft. high, with good round coping—seemed good; perhaps—in the country, anyhow—a thick and well-trimmed hedge could hardly be improved upon. A sunk hedge in some hilly districts should also be noted. Abroad, in Italy, one meets with shrines treated in colour, with lamps burning before them—certainly an interesting feature where found. He did not agree as to the oiling of oak work in the lych-gate; left untouched seemed to him much more satisfactory and better for weathering. He spoke with emphasis against white marble or polished granite, as not mellowing with time, and seeming cold and harsh amongst the other surroundings. He favoured, with Mr. Crawfurth Smith, the more frequent use of oak in monuments, either as a cross at the head of a grave, or else in the long board placed longitudinally with a post at either end, with inscriptions painted on white ground. Runic crosses (of which some photographs were shown) could hardly be looked upon as models for us nowadays, specially with their incised work, the *motif* of which is now almost unintelligible. He recalled a burial-ground belonging to the Society of Friends where all the tombstones were alike in height and all other respects, and he thought perhaps the quiet, peaceful, aspect so noticeable was largely due to this cause, and contrasted favourably with the showy and irregular treatment of a modern cemetery. Two features connected with the churchyards of old times had perhaps been overlooked—the stocks and the charnel houses. The latter existed connected with St. Paul's and also in Finsbury Fields.

Mr. Geoffrey Lucas, dealing more with cemeteries, recalled the Act by which if any cemetery was brought within 200 yards of any inhabited house, permission from landlord and tenant was to be obtained. The chapel, he held, too, was often a very doleful place, and when planned after the fashion of college chapels (mourners facing each other) was not so suited for requirements as when planned with seats the ordinary way, space for the bier and a special exit door being provided against the sanctuary. Artificial flowers ought always to be disallowed in a cemetery.

Mr. R. H. Weymouth called attention to the many interesting tombstone heads of the seventeenth and eighteenth centuries to be found in Suffolk, with flat carving in the head and scrollwork, and usually thinner (say 2½ in. to 3 in. thick), than modern headstones. The practice, too, of railing in any monumental cross, &c., close round the steps at its base seemed to detract from the quiet blending of the cross or monument with its surroundings.

Mr. Crook suggested that perhaps the reason that churchyards were mostly on the north side of the church might have been that the vicarages would naturally be placed on the sunny side in close proximity to the church, and hence this fashion might have arisen. He thought that marble monuments, especially for county families of some means, were quite reasonable, being so durable.

Mr. J. S. Blunt called attention to the oak crosses and lych gate to the churchyard at Cheam, the lych gate with shingled roof. Many of the trees, too, of churchyards throughout the country were historical, and sometimes artistically lopped and trimmed. He thought that perhaps Mr. Crawfurth Smith had overlooked in his paper the sundials to be found in many churchyards, especially in North Wales.

Mr. W. A. Pite viewed the churchyard as "God's Acre" and a "Garden of Sleep," therefore to be treated as no common field; and held that the way in which many churchyards in the country were kept, with sheep browsing, &c., was an absolute disgrace. He called attention to the beautiful treatment of the cemetery at Ramsgate by the late Mr. George Gilbert Scott, with its ample lych gate and rooms for keeper over. No churchyard should be viewed as a place of gloom and be full of ugliness (the mark of many modern monuments); it called on all hands for care and reverence. The tombstones of Old Germany consisted of a plain stone with bronze tablet let in—a method, though expensive in execution nowadays, certainly very satisfactory in appearance.

Mr. H. P. G. Maule agreed heartily with Mr. Pite's remarks, and thought the family vault ought to be certainly forbidden and disallowed as insanitary in the highest degree.

Mr. C. H. Brodie held that where churchyards in towns were disused and rights of way existed over them, paths outside the churchyard walls should be obtained, and many a churchyard in town has had its peaceful character and beauty spoiled by the broad asphalt pathways cutting it up into small irregular pieces. The old thin slate headstones, with flat carving, to be found in some parts, were very beautiful and suitable.

The Chairman called attention to the many uses the churchyard and the porch of the church were put to in former days, as for vestry meetings and proclamations by the sheriff, &c. A church house, for those who came from a distance to have their mid-day meal in, kept by the sexton, was (according to Mr. Baring Gould) the origin of many a public-house now just outside the churchyard. All must rejoice that the churchyards of Dickens' days were things of the past.

Mr. George H. Smith thought, perhaps, rather the church house was the home of the parish priest and his assistant, where they lived in times bygone. He understood that yew trees were ordered by Act of Parliament of Edward I.'s reign to be grown in all churchyards for the sake of making bows for the archers, but was himself a little uncertain as to this, and could not put his hands on the authority for this statement. With regard to the uses of the churchyard in former days, parish or miracle plays were generally held within it.

A cordial vote of thanks was accorded to Mr. Crawfurth Smith for his paper, and to Mr. George H. Smith for reading it on his behalf.

ARCHITECTURAL SOCIETIES.

DEVON AND EXETER ARCHITECTURAL SOCIETY.—The following is a summary of the substance of a paper read by Mr. James Crocker on the 6th inst., for which we have not hitherto been able to find space:—

Some Recent Law Cases as Affecting Professional Practice.

There are two or three classes of cases affecting us as a profession; such as actions for the recovery of fees, actions for alleged negligence in the fulfilment of duties, actions arising out of withholding certificates, and for penalties, besides other litigation having a bearing on building operations, although not directly between architect and client. I shall endeavour to place a few of these before you, giving only the leading facts and results, and classifying them as well as may be possible.

I take first the case of *Burrough Hill* v. *G. A. Barnard*, in which the plaintiff (an architect) claimed of the defendant (also an architect) 8*l.* 8s. 8d., balance of an account for attending court and giving evidence in support of the present defendant's claim for fees against his client, in which, after a three days' hearing, he had succeeded, with costs.

In the case of *Hutton v. Chorley* (heard before Mr. Justice Channell and a jury) the plaintiff claimed 147*l.* for preparing plans, specifications and quantities for altering and rebuilding an hotel, to cost 1.800*l.* or 2,000*l.*

Phipps & Jackson v. *Brownrigg* was a curious claim for 526*l.* 5s., prosecuted by the widow of the late C. J. Phipps and his partner, Mr. Arthur Blomfield Jackson, for plans and drawings for a proposed theatre in the Haymarket, and, in the alternative, damages by reason of the defendant's failure to get the plans approved of by the London County Council. His lordship said the matter had been shipwrecked by the action of the County Council in rescinding their approval of the site; but as that prevented the approval of the plans coming before the Council, he reluctantly gave judgment for defendant without costs, expressing the opinion that some satisfaction should have been given.

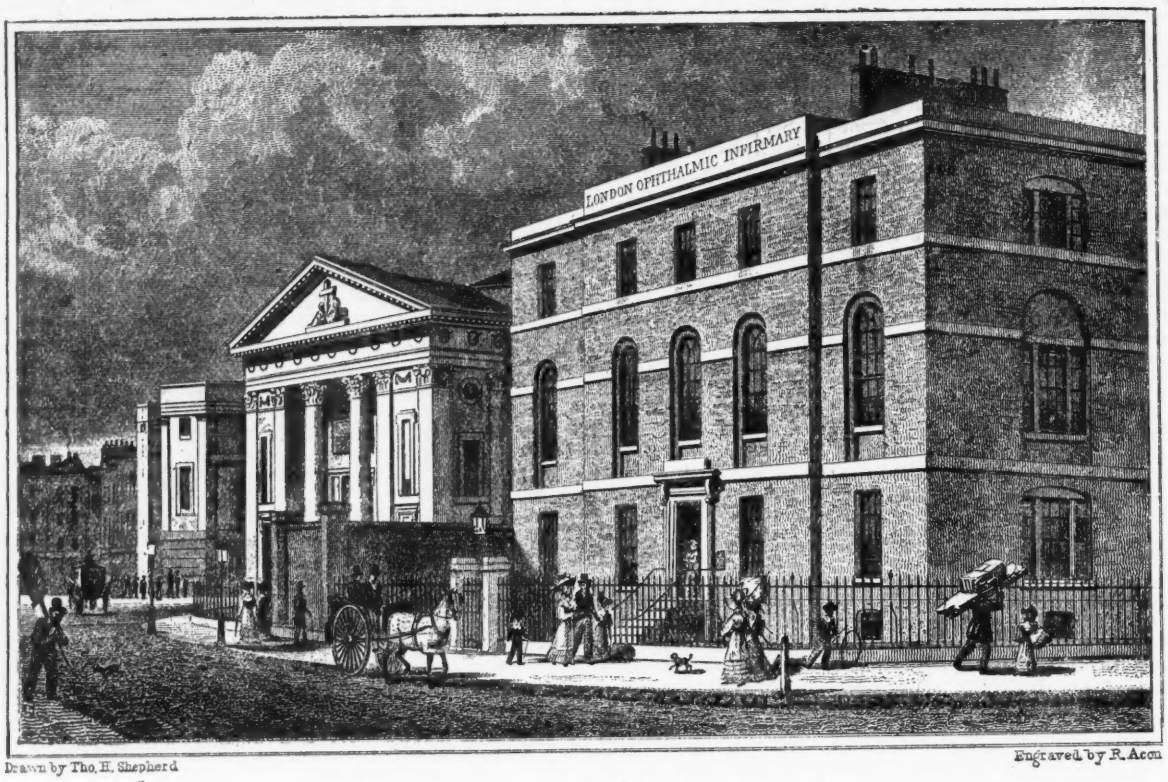
Whipham v. *Evcritt*, before Mr. Justice Kennedy in the Queen's Bench, is worth recording because of its bearing upon the scale of the Royal Institute of British Architects. Plaintiff brought an action to recover 169*l.* 16s., being 3 per cent. on 5,660*l.*, the amount of a single tender for plans and specifications for the erection of a villa at Saltburn.

I now pass on to summarise as briefly as possible the facts connected with the recovery of fees in a "quantity" case. One further case will perhaps suffice.

Arthur Crocker v. *C. J. Head.*—The former, a quantity surveyor of Fenchurch-street, sued the defendant, a chemist, for 24*l.* 15s. 6d. The plaintiff had, as is usual, received his instructions from the architect, it was said with the full concurrence of the defendant, but the latter denied this. The work was suddenly abandoned when the estimates came in, and the defendant settled his architect's account, but refused to entertain that of the quantity surveyor. He had, however, to pay it in full. This is not an uncommon contingency in the course of practice, and appears to prove that if an architect's instructions are to obtain tenders, he may do what is reasonably necessary in order to get them. Speaking broadly and generally, it is seldom a recalcitrant client can escape liability for work done by an architect when there is nothing of the nature of a speculative agreement between them. On the other hand, it is by no means certain that the 3 per cent. scale can be maintained for work abandoned after the tendering stage.

With reference to *Light and Air*, I will refer to two cases of a typical character, which may indicate how dangerous it is under certain conditions to take away even a small portion of that in which a man enjoys the same right as he does in his freehold.

May I say first that air is generally erroneously mixed up with light, and no action can be maintained for air unless it be so interfered with as to amount to something like positive contamination, rendering it injurious to health. The case of *Brown and others* v. *Collings* may come under this head. The *locus in quo* was in the High-street, Bromley, Kent (I have a rough sectional sketch of the facts). From it you will see that the width across from window to obstruction is about 60 ft., and the windows themselves are between projecting wings. That labelled "A" was the one argued on, as others followed it. Old sheds of defendant's building gave light over an angle of 12 deg. The new buildings were proposed to go up to about 32 deg., still leaving 58 deg. of sky surface, whilst the loss of light would be 20 deg. An injunction was applied for and an interim injunction granted in November, 1896. The case came before Mr. Justice Romer in, I think, June 1897, but he would not decide, and asked for both sides to agree to have a report from an architect. This was done and Mr. Gruning sent a report, saying in brief that under 45 deg. no obstruction was, as a rule, caused, but in this case, owing to window at "A" being so recessed by back buildings, he fixed the angle of obstruction at 33 deg., and as defendant did not go so high, he considered that plaintiffs had no case. The judge accepted this report, and the defendant completed his building, but on appeal, heard in February, 1899, thisw as reversed; the judges holding that *no* light previously enjoyed could be taken away, but hinting that the plaintiffs should not be too hard upon the defendant in letting him go up to a reasonable height. The result was that the latter was compelled to pull down one story, leaving the angle of obstruction about 23 deg. or 24 deg. only. Thus it appears that even in a width across of 60 ft., with an existing sky surface of 78 deg., when there is no *lateral* light, it may be possible for a dominant owner to maintain a right to *all* the light he has hitherto enjoyed. This is rather a startling possibility.



Drawn by Tho. H. Shepherd. Engraved by R. Acon

St. Mary's, Moorfields, and the Ophthalmic Hospital.

Illustrations.

DESIGN FOR A CHAPTER-HOUSE.

THIS design, by Mr. Percy E. Newton, was originally submitted in competition for the Soane Medallion some few years ago. It was this year exhibited in the architectural room at the Royal Academy.

The chapter-house is supposed to be attached to the south side of the cloisters of a cathedral church, and was to be fan-vaulted in stone from a central pier. It will be noticed that the equilateral triangle and hexagon enter largely into the plan. The buttresses are triangular on plan, and the turrets are hexagons contained in these triangles. There is a gallery at the window sill level, with a passage under. Underneath again is the crypt. The small windows high up light and ventilate the roof above the vaulting.

DESIGN FOR A STREET FRONT.

THIS is the principal elevation of the design for a street front by Mr. Henry Tanner, jun., which gained the Architectural Travelling Studentship at the Royal Academy this year. Mr. Tanner sends us the following note in regard to it :—

The design for the Street Front for the Royal Academy Studentship was to be for a frontage 120 ft. long, and to comprise four shops with flats and chambers over.

The total height was to be within that prescribed by the London Building Act—the number of floors not stated.

The entrance to the chambers above is in the centre, and the staircase (with lift in well) would be at back of central hall, lighted by area. The design is for a stone building, the fascia above shop fronts would be supported by girders.

THE WOOFINDIN CONVALESCENT HOME, SHEFFIELD.

THIS building, now almost completed, is situated on ground sloping down to the Porter Brook, and overlooks Whiteley Wood, a valley recently acquired for a public Park by the Sheffield Corporation. The site contains about seventeen acres, and is about three miles from the centre of the city.

The building has been placed on a plateau excavated out of the hill-side for the purpose, and is extended east and west so that the whole of the day-rooms may face south. The views across and along the Porter Valley are, on this side, very beautiful, and the building is quite protected on the north by high ground backed up by a belt of trees.

The entire cost of the building, as well as the endowment of the institution, is met by the bequest of the late George Woofindin, of Sheffield, and accommodation is provided for forty patients, who will have a free three weeks' visit. There will also be room for thirty additional patients, who may be admitted at a small charge.

On the ground floor, the dining-hall, together with the principal entrance hall—from which it is separated by an oak screen—occupies the centre of the front, and is marked by its greater height from the side wings. The above-mentioned apartment, 50 ft. by 24 ft., is lined to a height of 5 ft., with oak panelling. In the east and west wings are respectively the women's and the men's day rooms. The former comprise a reading and writing-room and a parlour ; the latter have, in addition to these rooms, a billiard and smoking-room. In the women's wing are also placed the business room and the matron's sitting-room. A wood verandah runs in front of each wing. Behind the above-mentioned rooms a straight corridor extends the whole length of the building, at the ends of which are placed box rooms, lavatories, cloak rooms, &c. On the north side of the corridor are matron's stores, the kitchen, and other offices.

On the first floor are the bedrooms, those for men being—as in the case of the dayrooms—in the west wing, and for women in east wing. In these the cubicle system has been adopted, the space being divided into rooms for two or three beds each by wood partitions 7 ft. high. The cubicle windows on the south front open out on balconies over the verandahs. Lavatories and bathrooms are placed—as on the ground floor—at the ends of the wings, and from these there is at each end an emergency door and escape stair in case of fire.

The central portion of the first-floor—which has been somewhat modified since the drawing was prepared—is on a higher level than the wings and contains the matron's bedroom, and cubicles so arranged as to be capable of being used wholly or in part for patients of either sex. The roof space is used for servants' bedrooms. The Enfield Company's best red pressed bricks from Accrington have been used for all the faces with Matlock stone dressings and Peakes mottled tiles for roofs. The floors throughout are of concrete covered with terrazzo or pitch pine blocks. The architects are Messrs. Hemsoll & Paterson, of Sheffield, and the contractors Messrs. Dawson & Jones, of Huddersfield and Sheffield.

DESIGN FOR AN ENTRANCE LODGE.

THE design for an entrance lodge is of the central archway type, and was suggested by a much smaller entrance at Cranborne Manor in Dorsetshire. It consists of two blocks planned diagonally, connected by an archway 12 ft. wide, with quadrant flank hedges forming a recess from the road.

The ground-floor contains a living-room, with stairs to the first-floor, and gardener's tool-house, and on the first-floor are three bedrooms. The materials proposed to be used are red brick with sandstone dressings ; the roof to be of stone slate.

The drawing was exhibited in the Royal Academy Exhibition of 1900.

H. INIGO TRIGGS.

DETAILS OF AN AMERICAN FRAME-HOUSE.

THESE constructional details are given in connexion with the second part of Mr. Budden's paper on "An American Frame-House," printed on another page, and are referred to there.

ST. MARY'S CHURCH AND THE OLD OPHTHALMIC HOSPITAL, MOORFIELDS.

THE demolition of St. Mary's Roman Catholic Church and the adjacent (old) buildings of the Royal London Ophthalmic Hospital in Moorfields is now in progress. The latter buildings were erected in 1824-5 after the plans and designs of Sir Robert Smirke, R.A., and, together with their site, were sold recently for 78,000*l*. The sale enabled the committee of management to erect new premises (at a cost of 80,000*l*.) upon a much larger scale, and with accommodation for 138 in-patients, on a site in City-road leased at 1,210*l*. per annum from the Ecclesiastical Commissioners, the architect being Mr. Keith D. Young, of the firm of Messrs. Young & Hall. Under a scheme framed by the Charity Commissioners, the proceeds, amounting to 202,000*l*, of the sale of the church, presbytery, and schools, are appropriated to the erection of a new church, with clergy-house and schools, upon a site which the trustees have bought in Eldon-street and Sash-court, Finsbury ; to a sum of 50,000*l*. in aid of completing the fabric of the new cathedral at Westminster ; and to a sum of 20,000*l*. towards the paying off of any mortgage of the cathedral's site ; the annual income will then be applied to the maintenance of the new buildings (to the extent of 400*l*. per annum) and the support of the cathedral. St. Mary's Church was built by Paynter & Haynes, contractors, in 1817-20, at a cost of 26,000*l*., after John Newman's plans and designs, for a congregation who had found a temporary settlement in White-street after the "No Popery"

rioters, on June 4, 1780, had burned Father Dillon's chapel, opened in 1744 in Ropemakers'-alley—now Ropemakers'-street. There seems to be no possibility of preserving the picture, 55 ft. by 33 ft., painted on the rounded wall of the apse by Aglio, of Cremona, and repainted by him in 1837,* of which, with the high altar and the marble columns (by Comulli, of Milan) in front of the picture, as lighted from above the entablature, we published an illustration from a drawing by Mr. A. C. Conrade, on November 25, 1899. High mass was celebrated in St. Mary's for the last time on Sunday, November 12, 1899. In July last the site, covering in all 18,400 feet superficial, was disposed of under a building lease for eighty years at a rental of 9,500*l.*

EDINBURGH ARCHITECTURAL ASSOCIATION:

BOTHWELL CASTLE.

AT a meeting of the Edinburgh Architectural Association recently, Mr. G. S. Aitken read a paper on "Bothwell Castle," which was illustrated by a series of specially prepared lime-light views. Having described the situation of the castle—on the north bank of the Clyde, about eight and a half miles south-east from Glasgow—Mr. Aitken went on to speak of the present ruin, which consists of the southern portion of the original building, conspicuous for its great western and south-eastern towers and their connecting walls, and occupying a space of about two-thirds of its ancient extent. The architectural features of these towers were dealt with, and the mason's marks in the great western tower were described. What object these marks served had, he said, not been determined, but the system was certainly very ancient, marks having been found on Egyptian masonry. Some experts supposed them to be symbolic; others that they were cut in the stones to show whose work they were, and how much the workmen were entitled to receive in payment. He would suggest, however, from an examination he had made of the ruins, that while the marks might be the property of particular masons, they also served the purpose of indicating the intended position of each stone in the building. The master mason, as any modern clerk of works would do, planned the various courses of masonry, marking in his drawing the symbol of each man to be engaged upon them, and allotting in that way to each hewer his work, which readily found its place in the building on reference to the master mason's original draft. The marks might also have been intended to aid in settling the amount of money that fell due to each, and at the same time assigning to the individual mason the credit due to him for workmanship.

Proceeding to speak of the history of the castle, Mr. Aitken said that three distinct families, the Olifards, Morays, and the Douglases, have been connected with Bothwell Castle from the time of its origin till the erection of Bothwell House—situated a little to the east, the centre and north wings of which were designed by James Playfair in the eighteenth century. If we examine the details of the various parts of the castle and determine their dates, it would not be difficult to find out what share each house had in their erection. We had good reason for stating that the western tower, enclosed within the inner bailey, was the work of the Olifards, because its detail is Early English, the vogue in their time. We go further to say there is every reason to suppose that they erected a complete castle with the more extended outline disclosed by the excavations undertaken in 1888. The period of their occupancy from the time of William Olifard, the second Justiciary of the Lothians, which was probably about 1180, and the date when Bothwell passed into the hands of the Morays (nearly 110 years), gave ample time to carry it out in its entirety.

It seemed clear that no building of any moment could have been done during the occupancy of the Morays from the year 1292 till the date of its dismantling in 1337. The English, who often held possession during this time, were not likely to extend it, and the Scots in their turn had no chance of doing so.

We infer, therefore, that it was carried out during the time of the Olifards; the assumption was eminently reasonable when we consider that according to a contemporary record, Caerlaverock Castle, which closely resembles Bothwell in idea, was by this date complete with its circular towers and curtain walls, and we have besides further confirmation in the condition of castle building across the Border, for at an earlier date than we are considering—the reign of Stephen of England—there had been erected 1,115 castles in England, many of them having the full arrangements of a fortalice, so that allowing for the late development of castle erection in Scotland, there is nothing unreasonable in assuming that Bothwell was complete prior to the invasion of Edward I., at the end of the thirteenth century. The dismantling in 1337, intended to render the castle useless to an invader, and to relieve the owner at the same time of the task of defending it, went so far, we may suppose, as the destruction of the western half of the great tower and the reduction in height of all the rest of the walls and towers.

As the Douglases when they came into possession in 1361 had Tantallon and Douglas Castles, we may presume that having these fortalices, they would only restore so much of Bothwell as served for occasional occupancy. If we assume that they confined their restorations to the south part, at present standing, this will solve all the difficulties of the date problem by assigning to *them* the erection of the banqueting-hall, chapel, and south-east tower, which are all works of their period. As a matter of course, they would make the great western tower available for living in by building the existing cross wall, and also complete their labours by enclosing the area connected with the reinstated castle by the erection of the present north curtain wall. This theory fits all the pieces of the puzzle together.

Mr. Thomas Ross, who moved a vote of thanks, expressed the hope that the lecture would be fully illustrated when published in the "Transactions." Mr. James Bruce, ex-President, in seconding, referred to the slide shown of the Douglas arms over the postern. The arms are ermine, a heart, on a chief three stars. He was followed by Mr. Rae Macdonald, Marchmont Herald, who gave some very interesting information on the heraldry of the castle.

IMPROVEMENTS IN BRIDGE CONSTRUCTION.

FROM the November issue of the *Journal of the Franklin Institute* we learn that the Elliott Cresson gold medal has been awarded to the Pencoyd Iron Works in recognition of the advanced position attained by that company in the field of bridge and other structural engineering. The works particularly selected for commendation by the Committee on Science and the Arts were the Niagara Falls and Clifton Bridge and the Delaware River Bridge, in connexion with which there are some features of special interest. In the case of the Niagara Bridge the conditions were both difficult and exacting; the main span is of unusual length—being fully 200 ft. longer than any such structure hitherto attempted—and the great depth of water and the rapidity of the current rendered false works impracticable. The structure is one of the type known as the two-hinged arch, consisting of two complete arch trusses, resting on cast steel abutments built into solid rock at each side of the river and rising to a height of 150 ft. at the centre. The points of interest in this case are, (1) the method adopted for closing up the arches at the centre, so that all undesirable strains due to cantilever erection are eliminated; and (2), the accuracy with which the whole work was made to carry its calculated strains. The Delaware River Bridge, built for the Pennsylvania Railroad Company, has three fixed spans of 533 ft. and one draw span of 323 ft. In the former the construction is such that all members are absolutely straight when under their maximum strain, and the secondary bending strain of the members is considerably reduced. The draw span is probably the heaviest example extant of centre-bearing construction. Some of its mechanical features are entirely novel, notably the counterbalanced latch, the catch for which is so arranged that if the draw reaches the closing point at too high a speed, the latch will pass over the opening without causing injurious shock to the structure.

THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

A BUSINESS meeting of this Institute will be held on January 7, when, after the election of candidates for membership, the Chairman will move the adoption of the amendments and additions indicated below, in the paper of "Suggestions for the Conduct of Architectural Competitions." The paper, as revised, reads as follows:—

"1. The promoters of an intended competition should, as their first step, appoint one or more professional assessors, architects of established reputation, whose appointment should be published in the original advertisements and instructions, and whose decision should govern the selection of the designs.

The President of the Royal Institute of British Architects is always prepared to act as honorary adviser to promoters in their appointment of assessors.*

All the designs sent in should be submitted to the assessors.

2. The duty of assessors should be—

(*a*) To draw up the particulars and conditions as instructions to competitors, and to advise upon the question of cost;

(*b*) To determine which of the designs conform to the instructions, and to exclude all others;

(*c*) To advise the promoters on the relative merits of the designs admitted to the competition, and to make a selection in accordance with the conditions.

3.† Every promoter of a competition, and every assessor engaged upon it, and any employee of either, should abstain absolutely from competing, and from acting as architect, for the proposed work.

4.† The number and scale of the required drawings should be distinctly set forth, and they should not be more in number, or to a larger scale, than necessary to clearly explain the design. If perspective views be required, it should be so stated; and they should be uniform in size, number, mode of colouring, mounting, or framing (if any), &c.

5. Competitions should be conducted in one of the following ways:—

(A) By advertisement, inviting architects willing to compete for the intended work to send in designs. The promoters, with the advice of the assessor or assessors, should make their selection from such designs. The author of the design awarded the first place should be employed to carry out the work.

(B) By advertisement, inviting architects willing to compete for the intended work to send in their names by a given day; with such other information as the candidate may think likely to advance his claim to be admitted to the competition. From these names the promoters, with the advice of the assessor or assessors, should select (*a*) an architect to carry out the work; or (*b*) a limited number to compete, and each competitor thus selected should receive a specified sum for the preparation of his design. The author of the design awarded the first place should be employed to carry out the work.

(C) By personal invitation to a limited number of selected architects, to join in a competition for the intended work. Each competitor should receive a specified sum for the preparation of his design. The author of the design awarded the first place should be employed to carry out the work.

6. No design should bear any motto, device, or distinguishing mark; but all designs should be numbered by the promoters in order of receipt. Any attempt to influence the decision of the promoters, or of the assessor or assessors, should disqualify a competitor.

7. In every case the amount of premium or remuneration for the competitive designs should be fixed‡ under the advice of the assessor or assessors, *and should be paid in addition to the usual professional charges for carrying out the work.*

8. Where a deposit is required for supplying the instructions, it should be returned on the receipt of a *bona fide* design; or if the applicant declines to compete and returns the said instructions within a month after their receipt.

9 § Each design should be accompanied by a

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* In a letter to the *Times*, November 18, 1899, his grand-daughter states that she possesses "a steel engraving, drawn, engraved, printed, and painted in the same colours as the picture by the artist himself," and the original design in water-colour for the ceiling which he painted at the same time.

* This sentence is new.

† Clauses 3 and 4, as they stand in the existing document, are as follows;—

3. Every promoter of a competition, and every assessor engaged upon it, should abstain absolutely from competing, and from acting as architect, for the proposed work.

4. The number and scale of the required drawings should be distinctly set forth, and they should not be more in number, or to a larger scale, than necessary to clearly explain the design. If perspective views be required, it should be so stated; and they should be uniform in scale, number, mode of colouring, &c.

‡ The existing clause reads:—

7. In every case the amount of premium or remuneration for the competitive designs should be fixed *by the promoters, acting* under the advice of the assessor or assessors, and should be paid in addition to the usual professional charges for carrying out the work.

§ Clause 9 is entirely new, and the following clauses have been re-numbered.

declaration, signed by the competitor, stating that the design is his own personal work, and that the drawings have been prepared under his own supervision.

10. A design should be excluded from a competition—

(*a*) If sent in after the period named (accidents in transit excepted);

(*b*) If it does not substantially give the accommodation asked for;

(*c*) If it exceeds the limits of site as shown on the plan issued by the promoters, the figured dimensions on which should be adhered to until officially altered;

(*d*) If the assessor or assessors should determine that its probable cost will exceed the outlay stated in the instructions, or the estimate of the competitor should no outlay be stated; provided always that should the assessor or assessors not have been consulted in the first instance respecting the cost, as recommended in paragraph (*a*) of Clause 2, and should he or they be of opinion that the outlay stated in the instructions is inadequate for the proper execution of the proposed works, the assessor or assessors shall not be bound in the selection of a design by the amount named in such instructions, but the question of cost shall nevertheless be a material element in the consideration of the award;

(*e*) If any of the other instructions are violated.

11. It is desirable that all designs submitted in a competition, except any excluded under Clause 9, should, with the consent of their authors, be publicly exhibited after the award has been made, which award should be published at the time of exhibition.

12. The architect whose design may be selected as the best should be employed to carry out the work, and he should be paid in accordance with the Schedule of 'Professional Practice as to the Charges of Architects' sanctioned and published by the Royal Institute. If no instructions are given to him to proceed within twelve months from the date of the selection, he should receive adequate compensation in addition to the premium (if any) awarded to him. In the event of a part only of his original design being carried out, he should be paid a sum to be agreed upon in respect of the deferred portion, such sum to be merged in the usual professional charge when the completion of the design is proceeded with.

*** It should be understood that the Royal Institute issues these suggestions as a guide to promoters where a competition has been decided upon, but not as necessarily recommending the principle of competition."

At the same meeting Mr. Lewis Solomon has given notice of his intention to move the following resolution:—"That the Institute is responsible for the inferior position of architects as compared with that of other professions, and that a committee be appointed to inquire into the causes of this inferiority of status and to suggest remedies."

THE POST-OFFICE LONDON DIRECTORY.

THE 102nd annual issue of this indispensable work (issued by Kelly's Directories, Limited, High Holborn, W.C.) contains all the useful divisions of previous issues corrected down to the latest moment compatible with its appearance at this time. The new House of Commons and Ministry and the new School Board are given, and the establishment of the Metropolitan Boroughs has been noticed in the Streets Division by the insertion in each street heading, after the Postal District, of the name of the Borough in which the street is situated. The arrangement of the work remains unaltered, but we regret that the interesting "note" which accompanied the 100th edition of the work, and which was included in the last edition, has been omitted—no doubt in order to economise space. Excluding advertisements, the Directory extends to nearly 3,500 pages and, as it appears necessary to add to that number from year to year, the time appears to have come when the work should be divided; for, valuable as the Directory is, it is somewhat unmanageable. Not the least valuable part of the Directory is an excellent map, mounted on linen.

The work has been carefully edited, but we regret to notice in the list of architects in "Trades" that the small "f" indicating Fellow of the Institute of Architects and the † indicating Surveyor have been rather indiscriminately used or omitted. Still, the Directory is a credit to its publishers.

SUNDAY SCHOOL BUILDINGS, ROGERSTONE, MONMOUTHSHIRE.—New Sunday school buildings have been erected at Rogerstone from plans by Messrs. Habershon, Fawckner, & Groves.

COMPETITIONS.

GLASGOW ROYAL INFIRMARY.—An adjourned meeting of the Executive Committee of the subscribers to the Queen's Diamond Jubilee Fund for the reconstruction of Glasgow Royal Infirmary was held in the City Chambers on the 19th inst. The minutes of the meeting of 12th current, and the minutes of the Sub-Committee on Plans of November 24 and December 3, containing reports of the assessor and measurers on the plans sent in by the ten competitors, having been read, Sir D. Richmond moved, and Mr. J. Glen seconded, that plan marked F, placed first in order of merit by the assessor, be adopted. Mr. John E. Nelson moved, seconded by Mr. John S. Templeton, that plan marked E be adopted, and Mr. Hugh Reid moved, seconded by ex-Bailie Robert Anderson, that plan marked B be adopted. These motions having been made, Dr. Rowand Anderson, the assessor, who was in attendance, answered some questions. Thereafter the vote was taken, when 8 members voted for plan F, 10 for plan E, and 3 for plan B. Plan B being struck out, its supporters voted on the other two plans, with the result that plan E had 11 votes and plan F 10 votes. The Lord Provost having opened the sealed envelope marked E the author was declared to be Mr. James Miller, I.A., West George-street, Glasgow. The Committee unanimously appointed Mr. Miller architect for the reconstruction of the infirmary, the work to be carried out in such manner and to such extent as the Committee may from time to time determine. The plan provides for the reconstruction of the whole of the present buildings, adapting them in every respect for the purpose for which they are intended. It is in the Scottish Baronial style, and forms three sides of a square, the opening being towards Castle-street. The cost of the reconstructed buildings is estimated at 224,500*l*.

Correspondence.

To the Editor of THE BUILDER.

"FRENCH ARCHITECTS AND SCULPTORS OF THE EIGHTEENTH CENTURY."

SIR,—In the important review kindly devoted by you in your number of December 22 to the second part of my work on French Art in the Eighteenth Century, you remark:—

"Whether the author has written altogether from personal observation of buildings, or from illustrations, is rendered rather doubtful by the remark in regard to Gabriel's Ecole Militaire—'Standing as we see it now from the Champ de Mars, in isolated dignity, it is impossible to imagine a more gracious and courtly building.' The Ecole Militaire has certainly never been seen from the Champs de Mars since the commencement of 1889, when the Galerie des Machines was completed, so that one must conclude either that the author has been imagining a little too much, or that this book has been in hand more than eleven years."

The writer of the review is, apparently, unacquainted with the distinction between the terms "Champ de Mars" and "Place du Champ de Mars." The "Champ de Mars" includes not only the "Place du Champs de Mars," but the avenues by which it is surrounded and the ground on which the Ecole Militaire stands. There is a space of 20 mètres at least between this building and the condemned Galerie des Machines (which masks at present the view from the "Place du Champs de Mars"), quite sufficient at any rate to allow one to see the Ecole standing in isolated dignity. I have just shown the article in the *Builder* to a most competent Parisian authority, who said:—"C'est comme cela que je vois l'Ecole moi-même du Champs de Mars. Il n'y a pas de bâtiment que l'approche; il y a 20 mètres entre elle et la Galerie des Machines; bien assez de recul pour la voir isolée dans sa dignité."

The only other hostile criticism regards the distribution of the tissue-paper titles. Allow me to say that this is not the work proper to the author, but to the binder, and as I have found them correctly distributed in several other copies, I hope there are but few examples of such regrettable confusion.

EMILIA F. S. DILKE.

Hôtel St. James.

*** In modern literature, French and English, and in ordinary conversation, the "Champ de Mars" is always understood to mean the open space itself; and as to a "Place du Champ de Mars," Baedeker at all events knows nothing of it, either in map of Paris or index; and to say that seeing the Ecole Militaire from the other side of the Avenue de la Motte Piquet is equivalent to seeing it from the Champ de Mars, is absurd. It is exactly because it is *not*, that the Paris authorities propose to demolish the Galerie des Machines, in order that Gabriel's building may really be seen from the Champ de Mars, as it used to be.—ED.

The Student's Column.

LESSONS IN ELECTRICAL ENGINEERING.

22. ELECTRIC TRACTION—POWER REQUIRED — SERIES - PARALLEL CONTROLLER — TRACTION DYNAMOS — OVERHEAD, CONDUIT AND SURFACE-CONTACT SYSTEMS —ELECTRIC BRAKES—DROP IN VOLTS—INDUCTION TROUBLES.

IN this country electric traction is at last beginning to make rapid progress. At the beginning of this year there were between fifty and sixty tramways operated by electricity, and at the end of the year there will be at least twenty more. The great success of the Central London Railway also will doubtless lead to the realisation of most of the projected twelve or fifteen underground electric railways for London. There are no signs at present of electricity being adopted for heavy railway work in this country, but it will doubtless come, as it has been already adopted in America, in Switzerland, and in Italy. In what follows we will consider the application of electricity to working street tramways, or as they are called in America street railways. We are accustomed to associate the word "tramway" with a small undertaking of no great financial or economic importance. Systems of electric trams, however, often rival railways in their importance, having armies of employees and competing successfully with railways when they happen to run parallel to one another.

In the early days of electric traction mistakes were made by putting in the cars motors much too small for the work they had to do. At first two 3 h.-p. motors were thought to be ample, but a little calculation would have shown the fallacy of this. An electric car loaded with forty passengers will weigh about ten tons. If this is going at the rate $7\frac{1}{3}$ miles per hour, *i.e.*, 11 ft. per second, and the friction of the rails is 30 lbs. per ton, then the work done in overcoming friction alone will be $10 \times 30 \times 11$ foot-pounds per second. But a horse-power is 550 foot-pounds of work per second, and hence the whole 6 horse-power will be expended in overcoming rail friction alone, leaving no margin for gradients, the increased friction going round curves, air friction, &c. In every electric car, now, are placed two 15 h.-p. motors at least, and if the gradients are steep two 25 h.-p. motors. As we have seen, the current taken by an electric motor is proportional to the power it exerts, and hence these motors work economically. Just at starting they exert great power and take a large current, but when the car has ceased to accelerate, the current has fallen to a third or a quarter of its initial value. It is this property of the electric motor of rapidly adapting itself to variable loads that makes it such a formidable competitor to the steam-engine.

To give an idea of the power required to accelerate a car to its regular speed, consider the case of a car weighing ten tons and getting up its speed of fifteen miles an hour in twenty seconds. At the end of the time its kinetic energy by the well-known formula in dynamics is $\frac{1}{2}\,mv^2$ foot-poundals, *i.e.*, $\frac{10 \cdot 2240 \cdot (22)^2}{2 \cdot 32} = 169{,}400$ foot pounds. If this energy were given to it at a uniform rate in twenty seconds, the motors would have to work at the rate of $\frac{169{,}400}{20 \cdot 550}$, *i.e.*, 15·4 horse-power. In addition, they would have to exert power in order to overcome friction, gradients, &c. If the car had to get up speed in ten seconds, then the power required for acceleration, if it remained constant for these ten seconds, would be 30·8 horse-power, and so on. It is found that the average power exerted at the car-wheel is only about the fifth part of the power exerted in the same place at starting the car. Manufacturers are now giving up the method of rating electric motors in horse-power, as this is unsatisfactory. A motor, for example, that could exert 15 horse-power safely for one minute might burn out if this load were left on for five minutes. Again it might exert 20 horse-power safely for a quarter of a minute. The method adopted by the General Electric Company of America in rating motors is a good one. They state the tractive effort in pounds that the motor could exert for one hour at the circumference of a 33-in. wheel when rotating at its working speed without raising the temperature

of the armature more than 138 deg. Fahr. The horse-power at this speed can be calculated from the formula

$$\text{Horse-power} = \frac{\text{(tractive effort) (miles per hour)}}{375}$$

For example, if the tractive effort, or, as it is sometimes called, the draw-bar pull, be 1,000 lbs., and the speed 7½ miles per hour, then the horse-power will be 20.

At first double-reduction gearing was used to connect the armature to the driving wheels, and so an efficiency of 60 per cent. was seldom attained. Now single-reduction gearing is almost universally employed, and an efficiency of at least 80 per cent. is attained. The speed is generally reduced four or five times. Of course, every form of gear is defective, and if it could be eliminated entirely there would be a great economy effected. In ordinary street working, however, the sudden starting and stopping would throw a great stress on a gearless armature, and the motor would be subjected to jars and jolts, as it could not well be coupled to the wheels by springs. In the City and South London Railway gearless motors are employed, but even on a railway they are constantly in need of repair. For street-running motors ought to be completely enclosed so as to be protected from dirt and moisture; and at the same time all the parts ought to be easily accessible for repair.

Having two motors on each car enables them to be connected up in various ways so as to diminish the strain on them and effect economies in working. This is effected by means of a series-parallel controller operated by the driver, which has now been developed to a great degree of perfection. The series of operations it performs as the driver turns the handle is roughly as follows. At first the motors are put in series with one another and with a resistance across the trolley wire and the rails. This prevents a sudden rush of current, as the difference of electric pressure is 500 volts. As the handle is turned, the resistance is gradually cut out until we have the two motors in series with 250 volts across the terminals of each. As the motors speed up the back, E.M.F. cuts down the current, hence they exert their maximum torque on starting just when it is most required. With the handle of the controller on this notch the speed is slow, but it is an economical position of working. On turning the handle, the fields of the motors are weakened so as to increase the speed; then one of them is cut out altogether, and a resistance is put in series with the other. Then the motors are put in parallel and the resistance cut out. We have now 500 volts at the terminals of each motor, and the speed of the motor is high. A higher speed can finally be got by shunting the field-magnets, thus weakening the fields and so allowing the armatures to rotate more quickly. The efficiency of the motor with the field-magnets shunted may be as high as with them unshunted, and hence this is an economical position. In the simplest form of controller there are thus four economical speeds: (1) the motors in series; (2) the motors in series, with their field-magnets shunted; (3) the motors in parallel; and (4) the motors in parallel, with their field-magnets shunted. Many forms of controller have much more elaborate arrangements. In this connection it is interesting to read the seventeenth of the Board of Trade Regulations issued in March, 1894: "In working the cars the current shall be varied as required by means of a rheostat containing at least twenty sections, or by some other equally efficient method of gradually varying resistance." If only resistance were used to vary the speed the working would not be economical. Sometimes four motors are used in a car, but the ordinary controllers can be easily adapted to this case.

The question of the site for a power-house is one of the greatest importance. Theoretically, of course, it ought to be near the centre of gravity of the lines supplied, but practically the engineer is restricted to the choice of two or three sites, none of which are very convenient; hence sub-stations, the power for which is transmitted electrically at high pressure from the central station, are necessary. In large systems it is customary to allow about 15 horse-power for every car that will be running at one time. Suppose, for example, that 10,000 horse-power is the maximum that will be required, then there ought to be in the station eight engines of 2,000 horse-power each, one or two being kept as a reserve. A tramway load sometimes fluctuates very rapidly, the instruments on the switchboard showing that the load may have altered by a thousand horse-power in a few seconds. It was at first thought that these sudden fluctuations of load would throw too great a stress on the engines if they were directly coupled to the dynamos, and hence rope-driving was used. It is found, however, that large engines run perfectly well when direct-coupled to traction generators, and hence direct-driving is used in all the new stations that are being built. Some of the dynamos used for traction work are very large, the whole machine sometimes weighing over a hundred tons, and the driving shaft being three feet in diameter. Mr. Parshall gives the following as the weights of the materials used in the construction of a 1,500 kilowatt traction dynamo:—

	lbs.
Copper in the armature winding...	4,000
Copper in the commutator	3,100
Copper in the shunt windings	5,700
Copper in the series windings	6,400
Total copper.....	19,200
Total cast steel.....	74,000
Total laminated steel	25,000
Total cast iron.....	38,000

The output of this machine was 2,500 amperes at 600 volts.

One of the earliest systems adopted for conveying the electric power to the cars was to make one rail the positive conductor, and the other the negative. It was found, however, that even with the low pressure of 100 volts, horses were thrown and badly hurt. Apart from this it was found that the electric leakage between the two was enormous, especially in wet weather, and hence this method is abandoned. For railways either overhead or underground, an insulated third rail between the other two is used and the current collected from it by a brush or shoe. For tramways, by far the most popular system is the overhead trolley. An insulated copper wire between a quarter and half-an-inch in diameter is suspended at a height of about twenty feet above the rails either from poles or by means of span wires. If span wires are used they are suspended either from poles on opposite sides of the street or from "rosettes" fixed on the walls of opposite houses. If poles are used they are generally of steel, and are fixed in concrete foundations and have brackets jutting out from them on which are insulators. The trolley wire is fastened to these insulators by means of "ears" made of bronze to which it is soldered. Great care has to be taken with the construction of insulators, as it is very difficult to insulate the trolley wire from the bracket arm. The current is collected from the trolley wire by means of a trolley wheel pressed against the wire by a trolley pole fixed on the roof of the car. After passing through the controller and motors it passes to the wheels and thence along the rails back to the station. The electrical connexion between the rails must, therefore, be good, and hence "bonding" them is an operation of great importance. When two overhead lines branch into separate circuits, "frogs" are used which guide the trolley wheel in the required direction.

The objection to the overhead system is that it is unsightly, and may prove dangerous in certain special circumstances. When telephone wires are stretched above the trolley wire, then, in the event of a break, if the telephone wire hit the trolley wire, a large current is sent through it, which may cause a disastrous fire at the telephone exchange or in a private house connected with it. This might be got over by putting fuses in the telephone circuits, and fire insurance companies now insist that this be done. Still, if a telephone or telegraph wire break it may touch the trolley wire and its free end rest on the ground. In this case any one lifting it up would get a serious, if not necessarily fatal, shock. "Guard wires" are sometimes hung over the trolley wire, or even a guard wire netting to prevent telephone wires falling on the trolley wire. From the point of view of the public these are objectionable, as they are very unsightly, and they are frequently a source of trouble to the company by touching and earthing the trolley wire. In America this method of protecting against the danger from falling wires is being abandoned.

Many attempts have been made to invent systems which will have no overhead wires at all. The most successful attempts can be divided into conduit and surface-contact systems. In the conduit system we have a conduit underneath the street containing the high tension cable. There is a narrow slit on the top of it through which the car makes contact with the cable by means of a shoe or skate which slides along it. This system is extensively used both on the Continent and in America, and was used for several years at Blackpool. The width of the slit (generally called slot) varies from ¾ to 1¼ inches. The drawbacks to the use of this system are the great expense of laying a conduit down the centre of a street which is often traversed by hundreds of pipes and mains of all kinds, and the great difficulty of keeping the conduit free from dirt and water. In a town in America it was found necessary to relay the whole sewerage system before the conduit could be laid.

The only difference in the appearance of surface-contact tramway systems from horse tramways is the appearance at intervals of four or five yards of one or more rounded knobs between the rails. As these knobs are 4 in. or 5 in. in diameter and only ½ in. high, they offer practically no obstruction to ordinary traffic. The cars in surface-contact systems have one or more bars underneath which made contact with the knobs as the car passes over them. The knobs can be connected to the positive underground main by electro-magnets attracting their keepers, and so completing the connexion or by other devices. The mere act of the contact bar touching a new knob makes that knob alive and at the same time disconnects the last knob from the main, and so leaves it perfectly safe to touch. In some systems, as the Westinghouse, the electro-magnet for each knob is actuated by a small battery in the car; in others it is actuated by current from the mains. Several miles of a surface-contact system have been operated in Paris and Lyons for the last four or five years, and there are several experimental lines in this country and America working successfully by means of surface contacts operated in various manners.

The design of brakes for electric cars has now been carried to great perfection. With the old hand-brakes quite a second was lost before the shoe touched the wheel. Hence, with a car moving at the rate of fifteen miles per hour, this meant that it had passed over 22 feet before the brake shoe touched the wheel. This 22 feet, therefore, has to be added to the distance in which the brake will stop the car. In the Bristol tramways the maximum speed allowed by the Board of Trade is eight miles an hour, but even in this case one second means 12 feet, and hence a rapid and efficient brake is necessary. We find, then, that the Board of Trade insist that the car must have an electric brake in addition to having brake blocks fitted to the wheels which can be worked by a screw or treadle. The principle of electric brakes is to convert the motors into generators operated by the momentum of the car, and at the same time an iron brake disc on the axle is rotated in the intense magnetic field caused by the currents, the iron brake shoe forming the magnetic circuit. We thus have three powerful forces tending to stop the car. First the force required to rotate the armatures in the strong magnetic fields; secondly, the drag on the brake disc due to eddy currents; and thirdly, the mechanical friction on the brake disc. The electric brake is operated by a controller similar to the series-parallel controller. The first notch converts the motors into generators, and succeeding notches gradually cut out the resistances across the terminals of the motors, thus increasing the currents and the braking effects. The electric brake is used for ordinary stopping as well as for emergencies, and will bring the car to rest on any grade.

When the rails are used to return the current to the power-house the Board of Trade insist that a continuous record be made of the difference of potential between the rails nearest and farthest from the station, and if this pressure be greater than seven volts the company have to take immediate steps to reduce it. The reason of this rule is to prevent current leaking from the rails and travelling to the power-station along gas or water mains. Where the current enters the water-pipe no destructive action takes place, but where it leaves the pipe the metal gets all eaten away, and the pipe soon bursts. A maximum pressure of seven volts distributed over several miles is not dangerous, although possibly after several years electrolytic actions may be noticed. It is the necessity of keeping down the "drop in

volts" in the rails that makes good bonding so essential, as this drop is proportional to the resistance of the rails as well as to the current. In several places good electrical connexion is secured between consecutive rails by the heroic expedient of welding them together. This has been found possible as the rails are nearly entirely covered in by pavement of some kind, and hence are held practically immoveable. Buckling of the rails or distortion of the paving is very rare when the rails are once laid. If the lines are long, or if the traffic be heavy, the rails are unable to carry all the current with a pressure of only seven volts. In this case feeder mains to the rails at various points are necessary. In addition series dynamos are sometimes employed to take current by a main from the distant end of the line to the station so as to keep the distant end at zero potential. A motor-dynamo (negative booster) can be employed for this purpose so that the regulation is done automatically.

In order to prevent the possibility of contact with the trolley-wire from carts, &c., the Board of Trade insist that its height from the surface of the street shall be at least 17 ft. Of course, even at this height there is a risk. For example, a waggon carrying a boiler, or a curved girder, or the metal pole of the waggon of a travelling merry-go-round, might easily come into contact with it, and fatal results might ensue. The supports for the trolley-wire must not be farther apart than 120 ft., so as to avoid the risk of the wire sagging. The Board of Trade also insist that arrangements must be made so that every mile of the trolley-wire can be insulated for testing purposes. If at any time it be found that the leakage current from the trolley-wire be more than half an ampere per mile of tramway, then the leak must be localised and removed within twenty-four hours, or otherwise the running of the cars must be stopped.

Trouble is often caused by induction in telephone circuits when the telephone wire runs parallel to the trolley wire. Even at distances of 100 or 200 yards the variable currents in the trolley wire cause a crackling in the telephone that sometimes makes conversation impossible. The remedy is to use twin wire for the telephone circuit. Trouble also has been experienced when the end of a submarine cable line is near a tramway system. The opening of the electric tramways at Cape Town upset the working of the instruments in the cable office for several months before a remedy could be devised. Electric traction has also stopped the work on terrestrial magnetism at several observatories. Observations at the observatories at Washington and Toronto only show the resultant of the earth's field and the magnetic field due to the currents in trolley wires in the neighbourhood, and are useless for comparison with results elsewhere.

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23. LIGHT — THE ETHER — INDUCTION TELEGRAPHY — PREECE — LODGE — WIRELESS TELEGRAPHY — HERTZ — MARCONI — CONCLUSION.

IT is now nearly fifty years since Weber and Kohlrausch measured the charge of a Leyden jar first in terms of the electro-magnetic unit, and then in terms of the electrostatic unit. They measured the charge in electro-magnetic units by charging the jar to a known potential and then discharging it through a galvanometer. The needle of the galvanometer swung round to a certain deviation where its angular velocity was destroyed by the opposing effect of the earth's magnetism. Hence, knowing the constant of the galvanometer, the time of the swing and the strength of the earth's magnetic field, they calculated the quantity of electricity that had flowed through the galvanometer in electro-magnetic units. They also measured the capacity of the jar by comparing it with a sphere whose capacity in electrostatic units is known to be equal to its radius in centimetres, and they measured the difference of potential between the coatings of the jar in electrostatic measure by means of an electrometer. Then the charge equals the product of the capacity and the difference of potential. By dividing one of their answers by the other they found that the ratio of the electro-magnetic to the electrostatic unit of electricity was equal to $3{\cdot}107 \times 10^{10}$. Now theory shows that this ratio is the measure of a velocity in centimetres per second. If we express it in miles per second, we find that it is 193,000 miles per second. Now this is very nearly equal to the known velocity of light in air, which has been frequently determined experimentally, and it was this close agreement which led Clerk Maxwell to elaborate his electro-magnetic theory of light.

The fundamental hypothesis in the theory of light is that there is an all-pervading medium called the ether, which is capable of transmitting light vibrations. It is supposed that this ether fills up the interstices between the molecules of solid bodies. In transparent bodies it is still capable of transmitting light vibrations, although at a different velocity, but in opaque bodies it has lost the power of transmitting the light vibrations. In the undulatory theory of light the vibrations that constitute a ray of light are supposed to be perpendicular to the direction in which the ray is travelling. If we throw a stone in a pond, waves start from the splash and proceed to the sides. The vibrations of the particles of water causing the waves are simply vertical and perpendicular to the direction in which the wave is travelling. In the same way the transverse vibrations of the jelly-like substance called the ether form a ray of light. Newton showed that white light could be dispersed by means of a prism into its various fundamental colours. In the undulatory theory waves of different colour are supposed to be formed by transverse vibrations oscillating with different frequencies. It is known that waves of different colour are all propagated with the same velocity in free space. Now if v be the velocity of a wave, l its wave length, and t the time of a vibration, then $l = v\,t$ and v is a constant. Hence if t the time of vibration is different, so also is l the wave length. If we make the supposition that the wave lengths are different, then the phenomena of diffraction, interference, &c., are all easily and most satisfactorily explained. The wave length of red light is to the wave length of violet light in the ratio of five to three nearly. The wave length of greenish-blue light is about the fifty thousandth part of an inch. This is by no means inconceivably small. Gold leaf can be beaten out until its thickness is only one three-hundred-thousandth of an inch, and when as thin as this it allows light to pass through.

The eye is only affected by vibrations of the ether whose wave-lengths lie in value between the wave-lengths of the red and violet rays at the extreme ends of the spectrum. Vibrations of longer or shorter wave-length are invisible to the eye, and hence we have to invent an instrument to detect them. The ultra violet rays can be easily detected by a piece of canary glass which is filled with a faint nebulous light (fluorescence) when placed in their way. A thermopile will detect the infra red rays and might be called a detector for the red rays. Now in systems of telegraphy we need two stations, a sending and a receiving station. At the sending station signals are sent out which travel either along wires or through space to the receiving station, where there is some instrument to detect them. When the signals are optical the eye is the receiving instrument, but if we use electric currents carried by wires, then some kind of galvanometer is necessary.

Recently, several successful attempts have been made to get rid of the connecting wires between the sending and the receiving station, and instead of utilising electric currents to send the signals recourse has been had to the older method of sending waves through space, only instead of light waves electric waves of various kinds have been utilised. Sir William Preece, in 1884, found that crackling noises heard in certain telephone circuits, stretched over the London streets, were caused by induction from telegraph wires buried in iron pipes underneath the streets. A telegraph expert could read the messages going through the telegraph wires by simply listening to the telephone. It was proved conclusively that these noises were due to induction, and not to conduction; that is the signals were transmitted through space between the two circuits. In 1886, by stretching two parallel wires on both sides of the Severn between Bristol and Gloucester, at a distance of four and a half miles apart, it was possible to signal by making and breaking the circuit on one side, and having a telephone in the circuit on the other side. In 1892 communication was established between Lavernock and Flat Holme, in the Bristol Channel, by this method. The distance is about 3·3 miles, and messages are now being sent daily between the two stations. No special skill is required on the part of the operators, and ordinary dry cells are used to send the intermittent current through the wires.

In 1895, Sir William Preece tried to signal between England and Ireland. In Ireland the circuit stretched from Belfast to Wexford, and in England from Carlisle to Haverfordwest. From midnight to 2 a.m. the whole telegraphic system of the country was stopped one Sunday morning. He thus describes the results of the experiment. "Attempts were made to signal, but it was impossible to distinguish a signal through the wonderful, incessant, and strange sounds that filled the telephone and overpowered everything else. No telegraph was at work anywhere. The hum of two or three electric light installations working on the alternating current system was evident, but there was a weird, strange babel of noises that was mysterious and disappointing. I am strongly of opinion that these sounds were due to disturbances excited by primary electrical effects outside our globe."*

Professor Oliver Lodge has devised a most ingenious system of space telegraphy. The sending circuit consists of a large coil of wire which is excited by alternating currents from a dynamo. The receiving circuit consists of a coil of wire, a condenser, and a telephone all in series. If the capacity of the condenser be varied until we have the condition for "resonance" at the frequency of the waves the coil of wire attached to the alternator is sending forth into space, then the signals can be heard for some miles. The great advantage of this system of space telegraphy is that the sending and receiving instruments can be tuned to one another so that the receiver only signals when the electro-magnetic vibrations have a particular frequency. We can thus have a sending and receiving station, sending messages without interference with the instruments of other stations in the vicinity.

The system of wireless telegraphy which has excited the greatest interest, is that with which Mr. Marconi's name is associated. He makes use of the electric vibrations which radiate into space from the sparks between the terminals of an induction coil. The theory of these vibrations has been worked out by Clerk Maxwell, and Hertz has experimentally verified some of his conclusions. These vibrations are generally referred to as Hertzian vibrations. When an oscillatory discharge, such as that produced at the terminals of an induction coil or by a Leyden jar discharging through a thick copper rod, takes place in a room where there are several metal objects close together, we sometimes see sparks between adjacent objects. This phenomenon is due to resonance, and is analogous to a note played on a musical instrument or sung, causing a gas globe to sound the same note. Hertz made use of this phenomenon to find out the laws which govern the propagation of these vibrations.

The apparatus he used was an oscillator to produce the sparks, and an explorer to find out whether they were reflected, refracted, or scattered. The oscillator consisted of a brass rod cut in two with a spherical ball at each end. Each half of the rod was attached to a terminal of the coil and the sparks took place between the ends of the rod. The explorer consisted of two thin wires with balls at the end, separated from one another by a minute gap. Now every spark at the terminals of the induction coil consists of a series of rapid oscillatory discharges. If we hold the explorer near the oscillator so that they are parallel to one another then there will be a flow of sparks across the air gap of the explorer when the oscillator is in action. The farther we take away the explorer the more feeble will the sparks be, until finally they cease altogether. It is found that they go through stone walls and wooden doors, but metal sheets screen off the vibrations entirely. If we hold a sheet of metal perpendicular to the direction of the vibrations, then the ray is reflected straight back, and we get the phenomenon of interference. When the explorer is held at certain distances from the metal sheet we get a maximum flow of sparks, and midway between those points we get points where there are no sparks at all. The distance between two points where there is maximum disturbance gives us the wave length of the electric vibrations. The waves Hertz experimented with were 30 centimetres long.

Hertz proved that these electric vibrations obey all the ordinary laws of light. By means of a parabolic mirror of sheet zinc held so that

* Journal of the Inst. of E. E., vol. 27, p. 876.

the oscillator was in the line of the foci, he managed to concentrate them into an electric beam, and by means of another parabolic mirror placed in the line of the beam, he concentrated the vibrations to the explorer placed in the focal line, and thus repeated the experiment of the conjugate mirrors in light. This proves that the electric vibrations are reflected in the same way as light vibrations. He also refracted an electric beam by allowing it to pass through a prism of pitch and found the index of refraction for pitch. Since also a metal sheet screens off the beam, this proves that it is propagated in straight lines. Again the vibrations are all parallel to the line joining the spark gap of the oscillator, they are therefore plane polarized, to use the language of optics. If we hold a screen of wires with the wires all parallel to the spark gap, the waves pass through it without difficulty, but if the wires are held perpendicular to the plane of vibration, the ray is quenched. The wire-screen is exactly analogous to a Nicol's prism. The phenomena are therefore identical with those of light and radiant heat. The only difference is that the wave length of the electrical vibrations is about a million times greater than that of the light vibrations. The explorer used by Hertz is, however, not sufficiently sensitive for telegraphy to any distance. The instrument used for this purpose is the coherer.

The coherer was invented by M. Branly, who described it in the *Comptes Rendus* (November 24, 1890.) It is a resistance made up of a substance in the form of powder or filings, contained in a glass or ebonite tube. In its natural state the electric resistance is very high, but when Hertz waves strike the tube, its resistance falls to only a few ohms. If the tube be now slightly tapped it will at once resume its normal condition, and the resistance rise to thousands of ohms, being virtually an insulator. The reason of this curious action seems to be that in its natural state the particles of powder lie about in all directions, touching one another lightly, but the moment they are subjected to the action of the electric vibrations they all become polarised and set themselves in a particular direction, the pressure between them making good contact, and hence lowering the resistance.

The transmitter used by Mr. Marconi in his system of wireless telegraphy is Professor Righi's form of Hertz oscillator. Two spheres of solid brass, each about 4 in. in diameter, fit inside a cylinder full of vaseline oil. We have two hemispheres in the air, and the other two are facing one another in a bath of oil. Close to the hemispheres in the air are placed two small brass balls, each of which is connected to a terminal of the induction coil. When the key of the induction coil is pressed the current from dry cells, with accumulators in parallel to them, excites the primary of the transformer, and we have sparks between the small brass balls and the large ones, and also between the large ones themselves. As the system possesses capacity and induction the sparks take place with extreme rapidity, and the electric vibrations starting into space have a wave length of about 4 ft. Now the latest determination of the velocity of light makes it very nearly 300,000 kilometres, or 187,000 miles per second, hence the frequency of the waves Marconi uses is $\frac{187{,}000 \times 5{,}280}{4}$ *i.e.*, 247 million per second.

The receiver used is a very sensitive coherer. It consists of a small glass tube about two inches long, into the ends of which two silver rods are tightly fitted. These rods are separated from one another by a space of about the fiftieth of an inch. The space between them is filled up with nickel and silver filings. The tube is then exhausted of air and sealed. In its normal condition this tube has a very high resistance, but when electric waves fall on it the resistance falls to about five ohms. This coherer forms part of a local circuit, being in series with a battery and an ordinary telegraph relay. Initially no appreciable current passes, but when electric waves fall on the coherer the resistance of the circuit at once falls, and the current works the relay. The relay closes a local circuit which works a Morse receiver and hence a permanent record is made of the signals in ink. At the same time the local circuit causes a small hammer to vibrate rapidly against the glass tube so as to make the filings decohere. Great care has to be taken that no sparking happens in the local circuit, otherwise the waves set up will affect the coherer and make signalling impossible. Sparking is avoided by shunting all the spark gaps with a non-inductive resistance. An essential and novel feature of Marconi's system is the long vertical conductor which is attached to one pole of the coherer, the other being connected to earth. The conductor is usually supported by a pole, but sometimes a kite or a balloon is used to suspend it.

A very simple experiment to illustrate wireless telegraphy can be shown by a Leyden jar, a coherer, a battery, and an ordinary electric bell. If the coherer, the battery, and the electric bell be joined up in series in one room and the Leyden jar be discharged in an adjacent one, then if the coherer is sensitive enough the bell will start ringing. A few taps on the coherer will make it decohere, and the bell will stop ringing.

Mr. Marconi has recently made many improvements in the apparatus he uses, which greatly increase its sensitiveness. He has sent signals over ninety miles without the necessity of an abnormally high wire, and there seems no reason to suppose that he has reached the outside limit. It seems probable that the curvature of the earth may impose some kind of limit, but it must be remembered that the great wave length of electric vibrations will enable them to bend round corners appreciably. At the present time experiments are being tried with wireless telegraphy on the North German Lloyd steamers. If we have steamers fitted with Marconi apparatus at equal distances from one another across the Atlantic, it will be obvious that continuous communication can be kept up from the shore with all of them. The Marconi Company are also fitting up stations for wireless telegraphy on various islands in the Pacific which it would be almost impossible to connect with one another by means of a submarine cable. It is to be hoped that Trinity House will see its way to fitting up permanently apparatus for wireless telegraphy on board lightships and in lighthouses.

In bringing these lessons to a conclusion, the writer feels that he has only touched the fringe of the subject. The commercial applications of electricity get wider every year, and during the last ten years the development has been increasing in a geometrical ratio, and in the future it will be necessary to specialise more and more. Again, although theory has advanced very rapidly, yet we are almost absolutely ignorant of what an electric current really is. When we close an ordinary electric circuit the starting current produces an electro-magnetic wave which travels into space with a velocity of about 187,000 miles per second. When the current is steady the ether round the wire is in a state of tension, tending to contract in the direction of the magnetic lines of force and to expand in the direction at right angles to them. We can suppose that there are cylindrical layers of ether round the conductor, those nearest being the most compressed. When the circuit is broken, these layers expand and give back energy to the circuit. An electric current is something very different from a fluid current; it heats the conductor, magnetises the surrounding medium, produces currents in masses of metal at a distance from it, and modifies the optical properties of bodies. The function of the conductor seems to be merely to direct the current, the real transport of energy taking place in the medium surrounding the conductor. If the conductor were at the absolute zero of temperature, then its resistance would be zero, and we need only have an infinitesimal filament of it to transport millions of horse-power thousands of miles. It is easier to imagine that the transfer of energy in this case takes place through the ether vortices round the wire than in the infinitesimal space occupied by the conductor itself. Speculation on this subject is very inviting, but until we know more about the constitution of the ether itself not very profitable. We hope that in the coming century a second Newton will arise to tell us what the ether really is.

MANCHESTER SEAMEN'S INSTITUTE.—The Committee of the Missions to Seamen has purchased a site, near the Docks in Trafford-road, for a seamen's institute and chapel. The new buildings will have two stories besides the basement. On the ground floor will be a large room, and behind and adjoining is a business-room for the chaplain. The chapel for daily and Sunday services will be on the first floor, approached by porches and staircases at each end. There will also be a clubroom for captains and other officers, and a small dwelling-house for the lay missioner. The estimated cost of the building will be 4,000*l*. The chapel will provide accommodation for 255 persons. The plans have been prepared by Messrs. Medland Taylor & Son, of Manchester.

OBITUARY.

MR. J. P. M'CANN.—The death is announced of Mr. John P. M'Cann, architect, of Aberdeen. Mr. M'Cann was at one time an assistant teacher in the Mechanics' Institute, and afterwards taught at the School of Art. After leaving the Art School he instituted the School of Design in Union-row, and conducted it for a time on behalf of the Aberdeen School Board. Deceased was forty-six years of age.

GENERAL BUILDING NEWS.

PRIMITIVE METHODIST CHURCH AND SCHOOLS, TRIMDON, NORTHUMBERLAND.—A new Primitive Methodist church and school premises, which have been erected near the railway station at Trimdon, were opened on the 14th inst. Mr. James Hunter was the architect.

PRESBYTERIAN CHURCH, STAFFORD. — The Presbyterian church in Mount-street, Stafford, was reopened on the 11th inst. after undergoing extensive alterations. A new wing has been added on the south side, together with a square tower with a spire. The new portion is of red pressed bricks with stone dressings. The work was carried out under the supervision of Mr. R. A. Glass, of Stafford. The cost was about 1,600*l*.

REOPENING OF LOXTON CHURCH, SOMERSETSHIRE.—The parish church at Loxton has just been reopened after restoration. The old roof has been replaced by one of pitch-pine, covered with Bridgwater tiles; an organ-chamber, to accommodate a new organ, has been built; and the church has been redecorated. The work was carried out by Mr. C. Addicott, of Weston-super-Mare, under the direction of Mr. Hans Price, of the same place.

PRIMITIVE METHODIST CHAPEL, BURTON.—The foundation-stones for the new Primitive Methodist structure at Wetmore-road, Burton, have just been laid. The buildings have been designed by Mr. Thomas Jenkins, architect, and are in the Early English style. The general contractor is Mr. J. Harlow, the stonemasons being Messrs. Parker & Stamp.

SUNDAY SCHOOL BUILDINGS, BASINGSTOKE.—The Sunday schools which have been erected on the site of the Hospital of St. Mary the Virgin and St. John the Baptist, in connexion with the parish church of Basingstoke, were opened recently. Mr. A. D. Sharp, of London, was the architect, and Mr. J. Thumwood, of Basingstoke, was the builder.

CHILDREN'S HOSPITAL, NOTTINGHAM. — Forest House, a mansion situated on Mansfield-road, has just been opened as a new children's hospital for Nottingham. The original building has not been much altered, but several additions have been made, the chief of which are a pavilion ward on the south side, an operating theatre, and several small wards. Messrs. R. Evans & Son, of Nottingham, were the architects for the alterations and additions, while the contractors employed were Mr. S. Ward and Mr. Henry Vickers, both of Nottingham.

EMPIRE THEATRE, SWANSEA.—On the 10th inst. was opened the new building which is to take the place of the old Swansea Empire. The building is of brick and stone, with a frontage of 72 ft. It consists of three tiers, viz., pit, pit stalls, and fauteuils, grand circle, gallery, and amphitheatre. The grand circle is entered from Lower Oxford-street through a wide vestibule and hall up a wide staircase. On each side of the grand circle is a staircase leading to the fauteuils; at the back of the circle is a corridor, off one side of which the foyer or lounge is approached, and this overlooks the street with swing doors opening upon a balcony, and on the other side of the corridor are the entrances to the private boxes at the back of the grand circle. The pit, pit stalls, gallery, and amphitheatre are provided with wide entrances and staircase from Lower Oxford-street, and the two latter are so arranged that the public can be under cover while waiting for the doors to open, and in all other cases waiting-rooms are provided. The buildings are of fireproof materials including the staircases. Hydrants are provided on each level, and also on the stage and dressing-rooms, and the auditorium is shut off from the stage by a fireproof curtain, along the top of which is a row of sprinklers. The building is heated by hot-water on the low pressure system by means of radiators. The interior is decorated in Italian Renaissance style by means of fibrous plaster. The dome is divided up into panels, filled in with paintings. The dome and proscenium arch are provided with electric light fittings. On the top of the dome is a sliding roof. The dressing-rooms are in a block by themselves, shut off from the stage by iron doors. The proscenium opening is 30 ft. wide and 30 ft. high, the stage is 32 ft. from the curtain line to the back wall, and the width 62 ft., and the distance from the grid to the stage is 57 ft. 6 in. In addition to the Empire with its frontage in Lower Oxford-street is the new tavern to take the place of the old Oxford Tavern, consisting of a saloon, private and public bars on the ground floor level, and a lounge on the first floor with living rooms over. Mr. John Linton, of Newport, was the contractor, and the carrying out of the work has been in the hands of Mr. Moon. Messrs. Dawnay & Co., of London, have provided the iron-work; Messrs. De Jong & Co., of London, the

decorative plastering and painting; Messrs. Merryweather, London, fire appliances and fireproof curtains; Mr. Cawdery, London, the stage; Messrs. Edwards & Armstrong, Cardiff, electric lighting fixtures; Messrs. Vaughan & Brown, London, gas-work, heating and speaking tubes, and electric bells; Messrs. Lazarus, London, seating; Messrs. Gibbons & Co., London, patent panic bolts; Messrs. Tyler & Son, London, sanitary fittings; Mr. Dutton, of Gloucester, the stone carving; and Mr. W. R. Brown, London, lead glazing. The architects were Mr. Walter Emden, of London, and Mr. W. L Griffiths, Newport, Mon.

CO-OPERATIVE SOCIETY STORES, BRENTWOOD.—The new stores of the Brentwood Provident Co-operative Society were opened on the 8th inst. The stores are situated at the corner of Crescent-road and Milton-road. The contract for the building amounted to 1,600*l*. Mr. T. W. Yirrell, of Brentwood, was the architect; and Mr. Ernest West, of Chelmsford, was the contractor.

EXTENSION OF CHESTER TRAINING COLLEGE.—On the 15th inst. a new practising school, which has been built in connexion with Chester Diocesan Training College, was opened. The new building, which has cost 4,000*l*., is a brick block, and has a frontage to Parkgate-road. It has been designed by Mr. H. Beswick, Chester, and built by Mr. W. W. Freeman. It will provide accommodation for 300 children as compared with 200 in the case of the old school. It consists of a central hall with gallery, five classrooms, head-master's room, lavatory, &c. The floors are all laid with wooden blocks, there is an improved heating system, and the building is lighted throughout by electricity.

WAREHOUSE, GLASGOW.—A large warehouse is being erected in the business centre of Glasgow. The block has frontages to Buchanan-street, Argyle-street, and Mitchell-street, the principal elevations being to the two first-named thoroughfares. Mr. Horatio K. Bromhead is the architect.

THE AUCTION MART, TOKENHOUSE-YARD.—Mr. Charles Herbert Shoppee has just carried out some interior improvements at the Mart, including a re-arrangement of the main stairs, which he has extended upwards to the second floor, with Portland stone steps, supported by girders of wrought steel, so as to provide better, and greatly-needed, means of access to the various salerooms above the first floor. The business of the Auction Mart was transferred to the premises, which, we believe, were not originally designed for that purpose, after the demolition in 1865 of the former auction rooms erected at the corner of Bartholomew-lane and Throgmorton-street in 1808-9, from the designs and plans of John Walters, who died in 1831.

BRADLEY HALL SCHOOL-CHAPEL, NELSON.—This building, just completed, has been designed primarily as a Sunday school, but with a view also to its use for a few years as a chapel, pending the erection of a chapel on part of the same site. The hall and gallery are seated for 500, while the classrooms give accommodation for 350 Sunday scholars. Externally the building is faced with Yorkshire parpoints and stone. The internal joinery is of Kauri pine. The cost of the building, with electric lighting and furnishing, will be 3,000*l*. The architects are Messrs. Shaw & Vowles, of Nelson and Burnley.

SANITARY AND ENGINEERING NEWS.

A MIDLAND WATERWAY SCHEME.—A deputation endeavoured on the 17th inst. to enlist the support of the Birmingham Corporation for a movement which has in view the opening up of free water communication between the Midlands and Bristol Channel ports. It was urged that Birmingham and the surrounding towns would reap immense advantage by the cheapening of freights on imports and exports. Sir Alfred Hickman, M.P., contended that this was the kernel of the commercial struggle between British and American manufacturers.—No hope was held out that Birmingham ratepayers would back the project.

NEW PIER FOR YARMOUTH.—A new pier is being erected at Yarmouth in place of the old Britannia pier. The pier will have an extreme length of 810 ft., with a pavilion and landing-stage at the sea end. The engineers are Messrs. Mayoh & Haley, of London, and the contractors are the Widnes Foundry Company, Limited.

FOREIGN.

FRANCE.—The cost of the proposed enlargement of the Paris Bourse by the addition of two side aisles, as proposed the architect M. Cavel, is estimated at 4,000,000 frs. The addition will give to the plan the form of a cross. The Municipal Council is in favour of the scheme.——M. Blavette, the architect, has been commissioned to prepare a design for the rebuilding of the Conservatoire de Musique, on the present site of the Caserne de Nouvelle France in the Avenue de Poissonnière.——One hundred and fourteen competitors have sent in designs for the pictorial decoration of the Salle des Fêtes of the new Mairie at Asnières. The jury, which includes several of the leading painters of the day, have selected the designs by MM. Henri Bouvet, Darieu, and Paul Schmitt, who are each to submit a panel of the size of execution, when the final decision will be made.——The Conseil-Général of the Seine have commissioned from M. René Billotte, the landscape painter, two large decorative panels for the principal staircase of the Mairie of Courbevoie; and from M. Steck and M. Eugene Bourgeois' two decorative paintings for the Mairie of Bagneux.——The authorities of Chalons-sur-Marne are about to lay out about 900,000*l*. francs on various important public works, especially the completion of the Museum and the rebuilding of the College.——M. Monzelas, architect, has been commissioned to make a study for the rebuilding of the church of Saint Pierre de Gros Caillou, in the seventh arrondissement of Paris.——The death is announced, at the age of seventy-two, of M. Charles Emile Saulmier, member of the Société Centrale des Architectes. Among the works in which he took part was the restoration of the Cathedral of Albi, the completion of the Palais de Justice at Carcassonne, as well as the museum in the same town, the Prefecture at Castlenandary and the savings bank at Carcassonne.

AUSTRALASIA.—At the time of the opening of the Federal Parliament it is proposed to hold a conference of architects, engineers, and surveyors in Melbourne. The Institutes represented are the Royal Victorian Institute of Architects, the Victorian Institute of Engineers, the Victorian Institute of Surveyors, the Architectural and Engineering Association, and the T-square Club of Victoria. The work of the conference will consist in making practical suggestions regarding the general conditions of site, the climatic influences, the setting-out, building, ventilating, lighting, tramway, water supply, drainage, &c., in connexion with the Federal capital, and impressing its decisions on the Federal Parliament. The movement is designed to provide all necessary data and information regarding the erection of a new and model city under most perfect conditions. The Governor-General will be asked to be President of the Convention, and the State Governors of the different Australian colonies will be invited to be Vice-presidents.——Competitive designs have been invited by the Wellington (New Zealand) City Council for a town hall and municipal buildings. The estimated cost of the whole buildings is 50,000*l*.——The statue of Commerce proposed to be placed upon the pediment of the new additions of the Exchange building, Sydney, is practically completed, and is to be unveiled on January 1 next; Mr. James White is the artist.——A large warehouse is being erected at Newtown, Sydney, from designs by Mr. James Nangle, architect, of Sydney.——The Metropolitan Water Supply and Sewage Board, Sydney, has adopted a recommendation from their Engineer that the sum of 15,000*l*. be expended for the erection of ventilating shafts in connexion with the sewage systems.——The works of supplying the town of Geelong, Victoria, with water are almost completed. The high levels of the town are to be supplied from what is called the Montpelier basin, the Engineer's estimate for which was 75,000*l*. About 400,000*l*. have been spent in connexion with the whole water supply scheme.

MISCELLANEOUS.

NATIONAL PHOTOGRAPHIC RECORD ASSOCIATION.—At the last Council meeting of this Association, 366 photographs were presented from all parts of the kingdom, forming a most valuable addition to the collection, recording, as they do, some of the most interesting subjects, both from an antiquarian and historical point of view. The President, Sir J. Benjamin Stone, M.P., sent in 100 prints taken in Warwickshire, including a series of Stratford-on-Avon and an interesting record of collecting the "wroth money" at sunrise at Ryton-on-Dunsmore. Mr. Sulman gave a set of the old historical houses of Hornsey and Highgate, many already removed; 103 from Mr. Geo. Scamell, Hon Sec., of the historical houses of London and the old Sussex churches, including Bosham, Sompting, Shoreham, &c.; some of Old Newgate by Mr. T. Bolas; Canonbury Tower and other contributions by E. Scamell; Worcester Cathedral by F. Littledale; many especially interesting records of Irish life and antiquities by Mrs. Muriel and A. Hogg, the latter sending a particularly fine series of the Tunnulus of New Grange, the interior views being splendid specimens of flash-light work. The Rev. A. C. Hervey contributed an interesting set of photographs of the old parish register showing extract of Act for burying in woollen—affidavits that such had been done—and another page certifying that certain families had paid the penalty of 5*l*. that their friends might be buried in linen. Mr. Clark forwarded a set of old crosses at Llantwit Major; Mr. Calcott an interesting record of many of the old houses of Bristol, several of which have been already removed; Mr. Felce a fine series of Norman capitals and misereres in the Northampton churches; Mr. Hodgson a long record from Kingston-on-Thames, and Mr. F. Parkinson a very complete set of the Easter sepulchre at Heckington Church. These photographs have now been forwarded to the British Museum, and together with hose already deposited, make up a collection of tearly 1,600 prints contributed by members of the Association.

SCARBOROUGH MASTER BUILDERS' ASSOCIATION.—The annual dinner of the Scarborough Master Builders' Association was held at the Albemarle Hotel, Mr. A. W. Sinclair (president) occupying the chair. Mr. J. F. Wilson proposed "Our Trades," to which Mr. C. Peckett responded; Mr. A. Moore proposed "The Master Builders' Association," and the President replied; Mr. G. F. Wells submitted "The Architects and Surveyors," which Mr. F. A. Tugwell and Mr. J. Caleb Petch acknowledged; and Mr. J. Atkinson gave "Yorkshire Federation of Building Trades," to which Mr. Ankers and Councillor Mansfield replied. Other toasts were "The Municipality and Trade of Scarborough," proposed by Mr. Woodhouse, and acknowledged by Councillor J. Bland; "Our Guests," proposed by Mr. G. Cail, and responded to by Mr. H. Wood; and "Our President," submitted by Mr. Horner, and supported by Mr. Barry, being received with musical honours.

THE OLD RED LION, STRAND.—The site of this old tavern will be taken for the new Gaiety Theatre and Gaiety Restaurant to be rebuilt after the plans and designs of Mr. Ernest Runtz, at the west end of the ground between the Strand and the proposed "island" block of buildings. An early mention of the tavern occurs in a list of tenements and holdings scheduled for an Act of Parliament, 1650. That Act was passed for purposes of the sale of "the honours, manors, and lands belonging to the late King, Queen, and Prince." Ludlow avers that in pursuance of a resolution of the House of Commons, Denmark, or Somerset, House, together with its appurtenances, the chapel excepted, were sold for 10,000*l*.

GLASGOW ARCHITECTURAL CRAFTSMEN'S SOCIETY.—The usual meeting of the Society was held on Friday, 21st inst., Mr. Isaac Low presiding. Papers were read on the subject of "Conditions of Contract," by Mr. Jas. A. Ferguson on joiners' work, Mr. Robert Ackenhead on masons' work, and Mr. Isaac Low on plumbers' work. Deducing the contents of the three papers, the following were the most important of the items commented on:—The upholding of work for the customary two years by the contractor was considered excessive, six months to one year being suggested as ample; arbitration in cases of disputes arising in the carrying-out of the contract; it was suggested that, in conditions wherein disputes were to be referred to the architect, whose decision would be final and binding, this might be more justly dealt with by the appointing of a representative of both the architectural and legal professions as arbitrators. The questions of time-clauses, extras, after measurement system, testing of materials, &c., were also discussed.

THE INSTITUTE OF SANITARY ENGINEERS (INCORPORATED).—At the half-yearly general meeting held on the 12th inst., the following officers were elected for the year 1901:—President: Dr. J. B. Wilkinson, D.P.H., &c, M.O.H. County Borough of Oldham and Consulting M.O.H. County of Huntingdonshire. Vice-Presidents: Dr. Thresh, M.O.H., Chelmsford; S. I. Adams, Mem.San.Inst.; H. M. Dove, Assoc.San.Inst.; J. Farley, C.E.; S. Minty, Assoc.San.Inst.; W. J. Wells, Assoc.San.Inst. Honorary Directors: Messrs. H. M. Dove, J. Farley, and W. J. Wells. Council: Messrs. J. Allan, F. P. Barber, E. Berrington, C. E. Butcher, H. G. Beams, G. H. Carter, E. D. Cecil, W. H. Coltart, T. W. Deadman, C. Dobbs, J. T. Griffin, R Horton, N. W. Hoskins, A. R. Hutson, J. Jenkins, W. E. Markham, F. W. Mason, T. R. Nash, E. R. Palmer, F. B. Patch, F. J. Rayner, W. Strachan, T. M. Taylor, and J. Thompson. Auditor: R. J. Ward, C.A., 2, Clements Inn, W.C.

CAPITAL AND LABOUR.

WAGES IN THE BUILDING TRADE.—A meeting of the Lancashire and Cheshire and North Wales Building Trades' Federation was held in the board-room of the Liverpool Master Builders' Association, Duchy Chambers, Sir Thomas-street, on the 19th inst. Mr. James Storrs (Stalybridge), the president, occupied the chair, and amongst those present were Messrs. Samuel Smethurst (Oldham), A. G. White, R. Stevenson Jones, C. W. Green, J. S. Brown, C. Tomkinson (Liverpool), G. M'Farlane, W. Marshall, H. Matthews (Manchester), T. H. Kellitt (Preston), W. Powell (St. Helens), J. Tomlinson (secretary) and Bertram B. Moss (secretary of the Liverpool Master Builders' Association). There were about 100 gentlemen present, and in addition two deputations, one from Newcastle and another from the Yorkshire Federation. After considerable discussion it was decided to support the Newcastle employers in their dispute with the bricklayers, who went out on strike in June last owing to the masters refusing to grant them an increase in wages of one penny an hour, the reason given by the employers being that the men were already receiving the maximum rate of wages paid in England.

THE PENRHYN QUARRY DISPUTE.—The conference between the Penrhyn quarrymen's delegates and Mr. Young, Lord Penrhyn's chief quarry manager, terminated in London on Saturday, and the delegates returned home to Bangor at midnight. The net result of the conference is that the men have gained no single concession except a promise that the stringency of the quarry rules will be somewhat relaxed, and the acceptance in a

modified form of a suggestion by the men that an experiment in co-operative bargains shall be tried in certain portions of the quarry. The men allege that this method of working would pay the management as well as, if not better than, the present contract system. No alteration is to be allowed in the present system of representation, a point which the men hold to be vital, and a minimum wage will not be guaranteed, as was requested. If the men accept the terms they may resume work on January 10.—*Standard.*

LEGAL.

THE ANCIENT LIGHT DISPUTE IN FINSBURY.

IMPORTANT ACTION AGAINST A BUILDER—JUDGMENT.

MR. JUSTICE JOYCE, on the 20th inst., delivered a considered judgment in the case of the Home and Colonial Stores *v.* Coles, an action brought by the plaintiffs to restrain the defendant from erecting a proposed building so as to obstruct the plaintiffs' ancient lights. The case was fully reported in the *Builder* of December 8 last.

The facts were shortly these: The plaintiffs were an incorporated company, having a number of shops in different parts of the country, and the premises now in question were the head offices of the plaintiffs, situate in Worship-street, City. At these premises the plaintiffs had something like 120 clerks. The plaintiffs' building was at the corner of Paul-street and Worship-street, Finsbury, and the only part concerned was the Worship-street frontage. The plaintiffs were lessees of the premises for twenty-eight years from the Ecclesiastical Commissioners. The defendant was a builder, and also lessee of premises which he was about to erect on the opposite side of the road. The premises which formerly stood on the site were 19 ft. 6 in. in height, and the defendant proposed to erect a building to a height of 42 ft., which the plaintiffs said would obstruct their lights. A great amount of conflicting expert evidence was called at the trial as to the probable effect of the defendant's proposed building on the plaintiffs' lights, and this was fully reported in the *Builder*.

Mr. Justice Joyce, in his judgment, after shortly stating the facts, said that upon the evidence he was of opinion that the building which the defendant proposed to erect would not materially interfere with the access of light to the windows on the first floor of the plaintiffs' premises. The only question he had to decide was as to the apprehended injury to the light coming to the windows on the ground floor of the plaintiffs' premises. "These windows are of large size, but, although the top light is said to be the most valuable and important, the uppermost part of each of the windows is filled with coloured glass to a depth of 20 in. from the top, and there are wire blinds fixed at the bottom of each window. The portion of the ground floor of the plaintiffs' building which is opposite the defendant's premises is used as an office. It consists of a large room 11 ft. 10 in. high and of unusual depth, the back wall being upwards of 50 ft. from the Worship-street front, and it has no window nor source of natural light at the back. This room contains several desks used by clerks in the employment of the plaintiffs for the purposes of their business. It is fitted with electric light, there being five rows of lamps in or near to the ceiling and arranged parallel to Worship-street. It is, I think, the result of the evidence that it has ordinarily, if not always, been the custom to use the electric light in the back part of the room, and it would require a most extraordinary amount of light from the windows in Worship-street to enable such use of the electric light to be dispensed with even on ordinary days. Practically I think it may be assumed that the use of electric or some other artificial light is now, and must always be, necessary in order to illuminate the back part of the room in the daytime. There is no evidence to show that any such extraordinary amount of light from the Worship-street windows has been enjoyed or required for anything like the period of twenty years. Probably the ground-floor rooms in the plaintiffs' premises were reconstructed or rearranged as they now are within quite a recent period. Various expert witnesses were examined, and, as the result of their evidence, I am of opinion that the proposed new building of the defendant would not affect the selling or letting value of the plaintiffs' premises. If erected to the proposed height of 42 ft. no part of the defendant's building would be high enough to reach any line drawn at an angle of 45 deg. to the horizon from any point in the base or sill of either of the windows in question belonging to the plaintiffs. But the defendant's building would, for its width of 36 ft. directly south of these windows, cut off a portion of the sky area now visible from within the plaintiffs' office, and it would, I think, to some extent necessitate, more frequently and during somewhat longer hours than at present, the use of artificial light in the front part of the office. It is practically admitted that the defendant's building might be raised a certain height—the plaintiffs' principal witness said to a total height of 25 ft. from the ground—without any material injury to the plaintiffs. Apart from any question with respect to the back part of the plaintiffs' premises and to the extraordinary amount of light required (if it could possibly be obtained) therefor in the absence of illumination by artificial light, the plaintiffs' premises would still, in my opinion, after the erection of the defendant's building, be well and sufficiently lighted for all ordinary purposes of occupancy as a place of business. If they were of only ordinary depth, they would have amply sufficient light." At present, in his Lordship's opinion, the plaintiffs' premises were unusually well lighted. If, as the plaintiffs contended, they were always entitled to the full amount of light they at present enjoyed, they would have had a good cause of action, although it might be doubted whether the diminution of light to their building by the defendant's proposed building would entitle them to an injunction. His Lordship could not reconcile the authorities which had been cited, but after considerable hesitation he had come to the conclusion that he must follow the decision of Mr. Justice Wright in the case of Warren *v.* Brown, and that the decision in that case ought, until it was reversed by the Court of Appeal, to govern this case. In those circumstances he thought that the action ought to be dismissed with costs.

Order accordingly.

RECENT PATENTS:

ABSTRACTS OF PATENTED INVENTIONS.

17,220.—AN APPLIANCE FOR WINDOW SASHES: *F. B. Marshall.*—In order that the sashes may be taken out of their frame or be turned into the room for purposes of cleaning them, the pulley stiles are fashioned with vertical grooves in which will slide some studs that are affixed to the sashes near the lower and upper rails, whilst the upper studs will move within horizontal grooves when the window is to be cleaned. Notches are cut in the detachable portions of the inside beads for engagement with the webs of T-shaped plates upon the beads' upper portions. For removal of the sashes from the frame one moves the two sets of studs along the upper and lower horizontal grooves which may be opened by turning pivoted plates backwards. In another form recessed plates that are let into the pulley stiles receive pivot pins mounted upon spring-plates attached to the sashes, or the upper sash can be moved into the frame's inner 'guiding-grooves by making the upper portions of the parting-beads detachable, one pair only of recessed plates being then necessary.

17,232.—A WATER-HEATER FOR BATHS: *A. Prost.*—Either wood or coal may be used in the furnace or fireplace. Water flows from the supply-pipe into two hollow vessels and thence into a boiler fitted with a double wall and a discharge pipe, a trough collects the products of combustion as they condense upon the boiler's inner wall, and the boiler is set upon a base which is provided with fire-bars.

17,241.—A MORTISING MACHINE: *W. Langner.*—The machine is intended for the cutting of mortises, channels, &c., in window-frames, doors, and so on. A crank-handle and bevel-gearing turn the cutting-tool, which is also traversed by means of a pinion geared within a rack upon the guiding-bed and driven from the cutter-shaft with reduction-gearing; the cutter is caused to traverse in the opposed direction through the impact at the end of a stroke of a bell-crank lever against a stop whereby the pinion is thrown out of gear with one rack and into gear with another rack upon the opposite side. A screw, fitted with hand-wheels, feeds the cutter forwards.

17,244.—PAINTS: *G. von Reinolts.*—A composition for use instead of white lead in the preparation of paints is made by mixing equal, or nearly equal, parts of carbonate of lead, sulphate of lead, oxide of zinc, sulphate of lime, and carbonate of lime. Of the last two ingredients one or the other may be discarded.

17,268.—MAN-HOLES, COAL-PLATES, &C.: *W. H. Kember.*—A flanged metal ring supports the door or plate, which is retained in its place by means of projections from either side of a stud upon the ring, a gravity catch which engages with a projection upon a bracket is pivoted upon lugs, a chain pulls a hooked lever so as to force its point against the catch, whose release lifts the plate, which can then be taken up by the hand.

17,272.—MEANS OF ESCAPE FROM FIRE: *L. Weber.*—By this contrivance the window-frame can be lowered to the ground, and a person can at the same time be carried with it. The cords which sustain the window-frame are passed over drums and through the eyes of upper and lower pivoted arms, which are disposed in pairs, and are to be held in their places with segmental guiding-plates. The lower arm of each pair is bent so as to serve for a strut through its pressure against the front wall of the building, whilst the upper arm of each pair is so hooked that it shall slide within a guiding-groove which extends up and down the face of the wall. As the frame is being lowered a cord, fitted with a counter-weight, becomes wound upon the axle of the drum. The frame, which may be hung upon only one pair of arms at each of its sides, is mounted upon rollers laid upon the window-sill.

17,284.—A METHOD OF GLAZING ROOFS: *A. S. Deacon.*—The sheets of glass are retained in their position by means of beaded wings fashioned upon drawn lead caps in which the sash-bars, whether of metal or of wood, are cased. According to one shape of the device, the edges of the cap act as a support of the lower lead-casing strip, and the wings are strengthened with plates or pins made of copper, brass, or other metal. In another adaptation, so that the glass shall not slide downwards, a pin or bolt is employed for fastening an end shoe or stop-piece on to the web at the bar's end. Expansion and contraction are provided for by joining the sash-bars to forked brackets upon the ridge-bars in which slots are cut for bolts that are passed through the bars.

17,319.—A GRIP FOR ELECTRICAL CONDUCTORS: *Steel Nut and Joseph Hampton, Limited, and S. Hampton.*—The grip is devised for use in hauling electrical conductors into tubular conduits; it consists of a tapered casing within which are attached three tapering guides, whose outer ends form three parallel guides having a screw box-head (with an eye) at their common end; between the guides of the outer ends slides a plate in which is pivoted the screw that turns in the box-head, the plate resting upon three slides whose toothed inner surfaces afford a grip for the cable.

17,359.—SCALES FOR SLIDE-RULES: *R. H. Smith.*—Around the middle and slightly recessed part of a cylinder is marked, spiral-wise, a logarithmical scale that ends in a circular scale divided into fifty equal parts; a slotted holder slides and turns over the cylinder, and over the holder slides an index ring having pointers, by means of which readings can be taken. The two slots of the holder are made wider than are the intermediate bars, whereof one—at the corners of one slot—carries four index-horns, the other bar being fitted with a straight scale divided into twenty equal parts; the zero of the scales become displaced accordingly with the circumferential and axial dimensions of the horns, the distance between them being equal to the distance from mark 100 to mark 1,000 upon the logarithmical scale.

17,366.—A METHOD OF GLAZING ROOFS: *W. Lawson.*—Tubular rivets made of lead or some soft metal are used for securing the supporting strips to the web of the glazing-bar; then through the rivets and through holes in the cap are passed bolts or other tubular rivets so as to fix the cap or cover in its place.

17,377.—HOISTING MACHINERY: *W. T. Eades & E. Allday.*—The lifting chain's sprocket-wheels are secured to a screwed axle upon which the hand-wheel also is mounted; a roller clutch set for engagement with the hub of a friction pulley that, under normal conditions, rests upon a band, prevents the outer sprocket-wheel from rotating in one direction, whilst a pawl and a ratchet-wheel likewise regulate the motion of the other sprocket-wheel. As the hand-wheel is turned in one direction it becomes jammed against the inside sprocket-wheel, and by causing it to turn, raises the load with the slow speed, but when the hand-wheel is reversed in direction it jams the other sprocket-wheel, and thereby raises the load with the faster speed. For an exertion of greater power the inventors put spur-gearing between the sprocket-wheels and the hand-wheel; for lowering purposes, the friction pulley is lifted from its contact with the band by the action of a lever upon the end of the shaft.

17,583.—JOINTING OF PIPES: *L. H. Holliday.*—The inventor fashions wedges upon the spigot ends and the socket ends of the pipes, in order that when the spigot end has been turned within the socket the engagement of the wedges shall effect a sure joint.

17,584.—A CONTRIVANCE FOR HEATING OR COOLING PURPOSES: *R. Commichau.*—The device consists of spiral metal ribs made in various shapes for attachment to the pipes of a heating, cooling, or refrigerating apparatus by means of grooves that are fashioned upon the pipes, or by an expansion of the pipes, or by the shrinking of the ribs on to the pipes, or with solder. The ribs can be used for heating-coils and stoves as well as for spirally-coiled pipes.

17,608.—CEMENTS FOR BUILDERS' USE: *W. Seidel.*—A paste containing 32 per cent. of moisture is made of argillaceous and calcareous marls mixed together with water in spherical mills; it is then finely ground between millstones, and mixed with dry cement materials in a kneading-machine so as to reduce the ratio of moisture by about one-third. Cement is made by drying and burning bricks composed of the admixture.

17,648.—EXTINCTION OF FIRE: *C. J. Patton and J. C. Grant.*—The extincteur consists of a casing of metal within which is an inner vessel of glass that encloses two smaller glass containers. The containers, having been filled with substances that will generate gas when they fall into a solution poured into the inner glass vessel, are hermetically sealed. For operative purposes the two containers are broken with a rod forced downwards upon them, and then will discharge their contents into the inner vessel. The resultant gas finds its escape through a Y-shaped tube upon inversion of the extincteur.

17,715.—SAFETY APPLIANCES FOR USE WITH ELECTRICAL LIFTS: *J. H. Johnson and W. R.*

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Forms of Tender, &c., Supplied by	Tenders to be delivered
Additions to Northfield, Bridlington	Mr. W. T. Foster	J. Earnshaw, Architect, Bridlington	Jan. 1
Widening Radyr-road	Llandaff R.D.C.	J. Holden, Civil Engineer, 35, St. Mary-street, Cardiff	do.
Lych Gateway	Cranleigh Parish Council	E. L. Lunn, Architect, 36, High-street, Guildford	Jan. 2
Rebuilding Blue Bell Inn, Ryhope, near Sunderland	Mr. J. Johnson	H. Grieves, Architect, Albany Chambers, South Shields	do.
Wood Paving (2,500 square yards)	Ramsgate Corporation	T. G. Taylor, Borough Surveyor, Broad-street, Ramsgate	do.
Sewerage Works, Dunham Massey	Bucklow (Cheshire) R.D.C.	J. McKenzie, Engineer, 7, Market-street, Altrincham	do.
Additions to Workhouse	Stoke-on-Trent Guardians	C. Lynam, Architect, Stoke-on-Trent	do.
Workshops, Stores, &c., Milford Haven	.....	D. E. Thomas, Architect, Haverfordwest	do.
Three Shelters, Darlow's Green	Southend-on-Sea Corporation	A. Fidler, Civil Engineer, Clarence-road, Southend	Jan. 3
Residence, Bowness	Mr. T. Harrison	R. Walker, Architect, Windermere	Jan. 4
Additions, &c., to Police Station, Holt	Denbigh County Council	W. R. Evans, County Offices, Ruthin	Jan. 5
Granite Road Metal (2,000 yards)	Hampton Wick U.D.C.	J. N. Horsfield, Surveyor, Hampton Wick	do.
Schools, Siddick, Cumberland	Workington School Board	Donald & Tate, Architects, 14, John-street, Workington	do.
Stables and House, Cragg Hall, near Mytholmroyd	.....	T. H. & F. Healey, Architects, 42, Tyrrel-street, Bradford	do.
Vicarage, Stable, &c., Rosedale Abbey, near Pickering	.....	J. Kirk & Sons, Architects, Huddersfield	do.
Chimney Shaft at Electric Lighting Station	Eastbourne Corporation	Borough Engineer, Town Hall, Eastbourne	Jan. 7
Steel Girder and Concrete Bridge	Clitheroe (Lancs) Corporation	J. Eastham, Town Hall, Clitheroe	do.
Widening Salterhebble Bridge	Halifax Corporation	J. Lord, Civil Engineer, Town Hall, Halifax	do.
Sewerage Works	Gildersome (Yorks) U.D.C.	J. Waugh, Civil Engineer, Tunbridge-chambers, Bradford	do.
Whinstone, &c.	Kingstown (Ireland) U.D.C.	J. Donnelly, Town Hall, Kingstown	do.
Five Houses, Boothtown, Halifax	.....	R. Berry, Architect, Commercial-street, Halifax	Jan. 8
Station Buildings, Glanamman, Carmarthen	Great Western Railway Company	G. K. Mills, Paddington Station, W.	do.
Well Sinking, Horsenden Hill	Thame U.D.C.	Taylor, Sons, & Santo Crimp, Engineers, 27, Great George-street	do.
*Electric Light Station and Destructor	Whitby U.D.C.	Clerk, Council Offices, Whitby, Yorks	do.
Additions to Mayfield Baths	Manchester Corporation	City Surveyor, Town Hall, Manchester	Jan. 9
Wesleyan Chapel, Swaledale	.....	Secretary, Building Committee, Kearton, Reeth, Yorks	Jan. 10
Additions to Business Premises, Elworth	Sandbach Co-operative Society	A. Price, Architect, Elworth, Sandbach	do.
*Postmen's Office at Clapham	Office of Works	J. Wager, Office of Works, Storey's Gate, S.W.	Jan. 15
Sewerage Works	Lutterworth R.D.C.	W. H. Simpson, Civil Engineer, Market Place, Leicester	Jan. 17
*Alterations and Additions to Laundry Machinery, &c	Metropolitan Asylums Board	Offices, Embankment, E.C.	do.
*Brick Storm-water Culvert	Hornsey U.D.C.	Engineer, Council Offices, Southwood-lane, Highgate, N.	Jan. 21
*School	Metropolitan Asylums Board	Newman & Newman, Architects, 31, Tooley-street, S.E.	Jan. 30
Factory, Holloway-road, N.	.....	A. Monk, 556, Holloway-road, N.	No date
Road Works	Yell (Shetland) Parish Council	J. N. Barclay, Mid Yell, Shetland	do.
Shop and Five Houses, Whitehouse, Belfast	Mr. J. Cassidy	W. J. Moore, Architect, Whitehall-buildings, Ann-street, Belfast	do.
Ice Factory, Milford Haven	.....	Freeman, Son, & Gaskell, Architects, Albert-chambers, Hull	do.
Additions to Foundry, Kendal	.....	J. Stalker, Architect, Kendal	do.
Mission Room and School, Churwell, Yorks	.....	R. Castle & Son, Architects, Cleckheaton	do.
Three Houses, &c., Dick-lane, Tyersal, Yorks	.....	F. Moore, Architect, 40, Sunbridge-road, Bradford	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary	Application to be in
*Building Inspector	Tottenham U.D.C.	150*l.* per annum	Jan. 9
*Draughtsman	Chiswick U.D.C.	100*l.* per annum	do.
*Assistant	E. Sussex County Council	75*l.* per annum	Jan. 12

Those marked with an asterisk (*) are advertised in this Number. *Competitions, p. —.* *Contracts, pp.* iv. vi. viii. & xviii. *Public Appointments, pp.* xvi. & xviii

Weeks.—The inventors' object is to provide means for operating a cut-out switch in the case of the cage being raised too high or too fast and for arresting its descent through a breakage of the rope or other accidental cause. The current is supplied by a cut-out switch to an electrical motor which drives the drum around which the lifting-rope is wound, the lift being normally regulated with a pull-rope which works the reversing switch. As the cage reaches its limit upwards a piece upon it strikes against a stop upon the upper end of a rod that moves in guides and to which is fastened a rope which works the cut-out switch. Should the speed prove to be in excess, a governor—driven with a weighted rope—operates upon a clamp, which in its turn grips the cut-out switch rope, and so moves that switch to arrest the cage. The cut-out switch may be also worked with a hand-clamp inside the cage that will grip the rope. In the event of the cage breaking away, the hinged sections that constitute one of the guides will thereupon be pressed inwards so as to stop the fall of the cage, the sections being so moved by a drum turned by a rope; the rope is gripped with a clamp that is worked with a governor driven by a weighted rope, or the rope may be held fast by a hand-clamp provided within the cage.

17,764.—SQUARES AND BEVELS: *E. W. Hutchinson and F. M. Wright.*—A right-angled extending-piece having round-ended prongs is attached to the one blade of the square, and the other blade is formed with a grooved tongue that fits into the double-bevelled edges of the extension-piece, a spring catch retaining the two blades together in position. A separate bevel, whose two parts are secured to one another with bolts, whilst each of them includes an adjustable and slotted blade, may be caused to slide upon the extension-piece, and so to take the place of the other blade, a grooved tongue being fitted upon one of the two parts of the bevel.

MEETINGS.

SATURDAY, DECEMBER 29.

Royal Victoria Hall (Waterloo-road, S.E.).—Professor Capper on "Niagara Water Power Installation." 8.30 p.m.

WEDNESDAY, JANUARY 2.

Institute of Sanitary Engineers.—Council meeting, 7 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary meeting of the members. 8 p.m.

THURSDAY, JANUARY 3.

Civil and Mechanical Engineers' Society.—Mr. W. B. Esson on "The Case for Electric Power Distribution." 8 p.m.

FRIDAY, JANUARY 4.

Architectural Association.—Professor Beresford Pite and Mr. R. Weir Schultz on "The Preparation of Studentship Drawings." 7.30 p.m.

Architectural Association of Ireland (Technical Demonstrations).—Mr. J. McGloughlin on "Ironwork" (at No. 47, Great Brunswick-street). 4.30 p.m.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

December 14.—By DAVID J. CHATTELL (at Chislehurst).

Chislehurst, Kent.—Green-lane, 9 freehold building sites	£1,270

By H. J. WAY & SON (at Totland Bay).

Totland, Isle of Wight.—The Avenue, Kernswald, u.t. 993 yrs., g.r. 15*l.*	770

December 17.—By GEORGE STOCKINGS.

Enfield.—Chase Side, Home Cottage, f., r. 20*l.*	300
Dalston.—77, Navarino-rd., u.t. 51 yrs., g.r. 5*l.*, r. 34*l.*	310

December 18.—By JOHN BOTT & SONS.

Herne Hill.—90, Railton-rd., u.t. 69 yrs., g.r. 5*l.*	450

By DAVID BURNETT & CO.

Lakenheath, Suffolk.—A freehold and copyhold estate, area 420 a. 2 r. 37 p.	2,000

By MARK LIELL & SON.

Stratford.—143 to 149 (odd), Leyton-rd., u.t. 80 yrs., g.r. 22*l.*, r. 112*l.*	£1,095
Ilford.—1 to 35 (odd), Pyrmont-rd., u.t. 77 yrs., g.r. 108*l.*	3,165
2 to 36 (even), Pyrmont-rd., u.t. 77 yrs., g.r. 108*l.*	3,150
Plaistow.—New Barn-st., a plot of building land, f.	195

By TRAFFORD & CARTER.

Camberwell.—126 and 130, Camberwell-grove, u.t. 14½ yrs., g.r. 20*l.*, r. 70*l.* 14s.	265
Kennington.—44 and 46, Finchley-rd., u.t. 50 yrs., g.r. 8*l.*, r. 60*l.*	615
Brixton.—18 and 20, Millbrook-rd., u.t. 22 yrs., g.r. 8*l.*, r. 58*l.*	400
Stepney.—11 and 12, Trafalgar-sq., f.	990
Hackney.—15, King Edward-rd., u.t. 22½ yrs., g.r. 6*l.* 16s., e.r. 70*l.*	390

By HEPPER & SONS (at Leeds).

Bramley, Yorks.—Hough End Tannery, together with 2 houses, 23 cottages, &c., area 10 a. 3 r. 9 p., f.	12,000
Swinnow-rd., 3 closes of building land, 9 a. 1 r. 23 p., f.	1,535

By S. P. GRAVES & SON (at Southam).

Southam, Warwick.—The Holt Farm, 94 a. 2 r. 6 p., f.	1,400
Oven and Holt Church Meadows, 19 a. 3 r. 11 p., f.	480
The Allotments, 59 a. 2 r. 30 p., f.	1,700

By CRAFTER, HARRIS, & CO. (at Masons' Hall Tavern).

Streatham.—Mitcham-lane, The Streatham Park Hotel, u.t. 60 yrs., g.r. 20*l.*, r. 1,000*l.*	2,450

December 19.—By FRANCIS DOD & CO.

Woodford.—George-lane, Laurestinus Villa, f.	650
Stoke Newington.—78, Park-st., u.t. 47½ yrs., g.r. 2*l.* 18s. 3d., e.r. 34*l.*	395
Dalston.—21, Ferncliff-rd., u.t. 60½ yrs., g.r. 6*l.*, e.r. 40*l.*	420

By CHARLES HALL.

Clapham Common.—105, North Side, u.t. 70 yrs., g.r. 24*l.*	450

By G. F. HAWKINS.

Maida Vale.—62, Sutherland-av., u.t. 63 yrs., g.r. 11*l.*, e.r. 65*l.*	700

Portman-sq.—14 and 15, Dorset-st., u.t. 13¾ yrs., g.r. 80*l.*, r. 245*l.* £880

By F. PERKS.

Paddington.—Delamere-ter., i.g.r.'s 34*l.* 10s., u.t. 48 yrs., g.r. nil 690
Blomfield-pl., i.g.r. 33*l.* 4s., u.t. 48 yrs., g.r. 2*l.* 535
Blomfield-pl., i.g.r.'s 45*l.* 8s., u.t. 48 yrs., g.r. nil 791

By ROBINS, GORE, & MERCER.

Tottenham Court-rd. — 33, Percy-st., beneficial lease for 15¼ yrs., r. 90*l.* 250

By THURGOOD & MARTIN.

East Molesey, Surrey.—12 to 23, Avern-rd., f. .. December 20.—By EDWIN EVANS. 2,120
Stroud Green.—117, Ferme Pk.-rd., u.t. 89 yrs., g.r. 8*l.*, e.r. 45*l.* 485
Portman-sq.—15, King-st., u.t. 5¼ yrs., g.r. 35*l.*, r. 100*l.* 125
Wandsworth-rd.—No. 555, u.t. 63 yrs., g.r. 10*l.*, e.r. 50*l.* 495

By SIBLEY, COOKES, & BURRELL.

Peckham.—59, 61, 63, and 65, Lower Park-rd., f., r. 80*l.* 1,485

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.	
Hard Stocks	1 16 0	per 1,000 alongside, in river.
Rough Stocks and Grizzles	1 12 0	" " "
Smooth Bright Facing Stocks..	2 18 0	" " "
Shippers	2 6 0	" " "
Flettons.....	1 10 6	" " "
Red Wire Cuts ..	1 15 6	at railway depôt.
Best Fareham Red	3 11 6	" " "
Best Red pressed Ruabon Facing.	5 5 0	" " "
Best Blue Pressed Staffordshire ..	4 7 0	" " "
Do., Bullnose	4 12 0	" " "
Best Stourbridge Fire Bricks	4 4 6	" " "
GLAZED BRICKS.		
Best White and Ivory Glazed Stretchers.....	13 0 0	" " "
Headers	12 0 0	" " "
Quoins, Bullnose, and Flats	17 0 0	" " "
Double Stretchers	19 0 0	" " "
Double Headers..	16 0 0	" " "
One Side and two Ends	19 0 0	" " "
Two Sides and one End	20 0 0	" " "
Splays, Chamfered, Squints	20 0 0	" " "
Best Dipped Salt Glazed Stretchers and Headers ..	12 0 0	" " "
Quoins, Bullnose, and Flats	14 0 0	" " "
Double Stretchers	15 0 0	" " "
Double Headers..	14 0 0	" " "
One Side and two Ends	15 0 0	" " "
Two Sides and one End	15 0 0	" " "
Splays, Chamfered, Squints	14 0 0	" " "
Seconds Quality White and Dipped Salt Glazed ...	2 0 0	" less than best.

	s. d.	
Thames and Pit Sand	8 0	per yard, delivered.
Thames Ballast	6 9	" "
Best Portland Cement	38 0	per ton "
Best Ground Blue Lias Lime..	24 6	" "

NOTE.—The cement and lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 12s. 6d. per yard, delivered,
Stourbridge Fire-clay in sacks, 32s. 6d. per ton at rly. dpt.

STONE.

	s. d.	
Ancaster in blocks ...	2 0	per ft. cube, deld. rly. depôt
Bath "	1 7	" "
Farleigh Down Bath ..	1 8	" "
Beer in blocks	1 6½	" "
Grinshill "	1 10	" "
Brown Portland in blocks	2 2	" "
Darley Dale in blocks..	2 1½	" "
Red Corsehill "	2 5	" "
Red Mansfield "	2 4½	" "
Hard York in blocks ..	2 10	" "
Hard York 6 in. sawn both sides landings, to sizes (under 40 ft. sup.)	2 8	per ft. super.
" " 6 in. Rubbed Ditto..	3 0	at rly. depôt. " "
" " 3 in. sawn both sides slabs (random sizes)	1 3	" "
" " 3 in. self-faced Ditto	0 9½	" "

PRICES CURRENT (*Continued*).

SLATES.

in. in.	£ s. d.	
20×10 best blue Bangor..	11 5 0	per 1000 of 1200 at ry. dep.
" best seconds "	10 15 0	" "
16× 8 best "	6 2 6	" "
20×10 best blue Portmadoc	10 18 0	" "
16× 8 best blue Portmadoc	6 0 0	" "
20×10 best Eureka unfading green.....	11 2 6	" "
16× 8 " "	6 15 0	" "
20×10 Permanent green	10 0 0	" "
16× 8 " "	5 12 6	" "

TILES.

	s. d.	
Best plain red roofing tiles..	41 6	per 1,000 at rly. depôt
Hip and valley tiles....	3 7	per doz. " "
Best Broseley tiles	48 6	per 1,000 " "
Hip and valley tiles....	4 0	per doz. " "
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000 " "
Do. ornamental Do.	60 0	" " "
Hip tiles.....	4 0	per doz. " "
Valley tiles.....	3 9	" " "
Best Red or Mottled Staffordshire Do. (Peakes).	50 9	per 1,000 " "
Hip tiles	4 1	per doz. " "
Valley tiles.....	3 8	" " "

WOOD.

BUILDING WOOD.—YELLOW.

	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9in. and 11 in.	16 10 0	18 0 0
Deals: best 3 by 9	14 10 0	15 10 0
Battens: best 2½ in. by 7 in. and 8 in. and 3 in. by 7 in. and 8 in.....	12 10 0	13 10 0
Battens: best 2½ by 6 and 3 by 6 ..	0 10 0	less than 7 in. and 8 in.
Deals: seconds	1 0 0	less than best
Battens: seconds.....	0 10 0	" " "
	At per load of 50 ft.	
Fir timber: Best middling Danzig or Memel (average specification)	4 10 0	5 0 0
Seconds	4 5 0	4 10 0
Small timber (8 in. to 10 in.)	3 12 6	3 15 0
Swedish balks.....	2 15 0	3 0 0
Pitch pine timber (35 ft. average)..	4 0 0	4 10 0

JOINERS' WOOD.

	At per standard.	
White Sea: First yellow deals, 3 in. by 11 in.....	27 10 0	28 10 0
3 in. by 9 in.	24 0 0	25 0 0
Battens, 2½ in. and 3 in. by 7 in.	20 0 0	21 0 0
Second yellow deals, 3 in. by 11 in.	22 10 0	24 0 0
" " 3 in. by 9 in.	20 0 0	21 0 0
Battens, 2½ in. and 3 in. by 7 in.	16 10 0	18 0 0
Third yellow deals, 3 in. by 11 in. and 9 in.	16 10 0	18 0 0
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	14 10 0
Petersburg: first yellow deals, 3 in. by 11 in.	25 0 0	26 0 0
Do. 3 in. by 9 in.	22 0 0	23 0 0
Battens.....	16 10 0	17 10 0
Second yellow deals, 3 in. by 11 in.....	18 10 0	20 0 0
Do. 3 in. by 9 in.	17 0 0	18 0 0
Battens.....	14 0 0	14 10 0
Third yellow deals, 3 in. by 11 in.....	15 0 0	16 10 0
Do. 3 in. by 9 in.	14 0 0	14 10 0
Battens.....	12 10 0	13 10 0
White Sea and Petersburg:—		
First white deals, 3 in. by 11 in..	15 10 0	16 10 0
" " " 3 in. by 9 in. ..	14 0 0	15 0 0
Battens.....	12 10 0	13 10 0
Second white deals 3 in. by 11 in.	14 0 0	15 0 0
" " " 3 in. by 9 in.	13 0 0	14 0 0
" " battens	11 0 0	12 0 0
Pitch pine: deals	16 0 0	18 0 0
Under 2 in. thick extra	0 10 0	1 0 0
Yellow Pine—		
First, regular sizes	30 0 0	33 0 0
Broads (12 in. and up)	2 0 0	more.
Oddments	22 0 0	24 0 0
Seconds, regular sizes	24 10 0	26 10 0
Yellow Pine Oddments	20 0 0	22 0 0
Kauri Pine—		
Planks, per ft. cube	0 3 6	0 4 6
Danzig and Stettin Oak Logs—		
Large, per ft. cube	0 2 6	0 2 8
Small " "	0 2 4	0 2 7
Wainscot Oak Logs, per ft. cube ..	0 5 0	0 5 6
Dry Wainscot Oak, per ft. sup. as inch	0 0 8	0 0 9
¾ in. do. do.	0 0 7	- - -
Dry Mahogany—		
Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0
Dry Walnut, American, per ft. sup. as inch.....	0 0 10	0 1 0
Teak, per load	16 0 0	20 0 0
American Whitewood Planks—		
Per ft. cube.....	0 2 3	0 3 0

JOISTS, GIRDERS, &c.

	In London, or delivered to Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	8 7 6	9 7 6
Compound Girders " "	10 5 0	11 10 0
Angles, Tees and Channels, ordinary sections	11 2 6	13 2 6
Flitch Plates	11 0 0	11 15 0
Cast Iron Columns and Stanchions, including ordinary patterns	8 15 0	10 10 0

PRICES CURRENT (*Continued*).

METALS.

IRON.—	Per ton, in London. £ s. d.	£ s. d.
Common Bars.....	9 15 0	- - -
Staffordshire Crown Bars, good merchant quality	10 5 0	10 10 0
Staffordshire "Marked Bars" ..	12 0 0	- - -
Mild Steel Bars.....	10 10 0	11 0 0
Hoop Iron, basis price.....	10 10 0	11 0 0
" " galvanised	16 10 0	- - -
(* And upwards, according to size and gauge.)		
Sheet Iron, Black.—		
Ordinary sizes to 20 g.	11 0 0	- - -
" " to 24 g.	12 0 0	- - -
" " to 26 g.	13 10 0	- - -
Sheet Iron, Galvanised, flat, ordinary quality.—		
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.....	13 5 0	- - -
" " 22 g. and 24 g.	14 5 0	- - -
" " 26 g.	16 0 0	- - -
Sheet Iron, galvanised, flat, best quality.—		
Ordinary sizes to 20 g.	17 10 0	- - -
" " 22 g. and 24 g.	18 0 0	- - -
" " 26 g.	19 10 0	- - -
Galvanised Corrugated Sheets.—		
Ordinary sizes, 6 ft. to 8 ft. 20 g.	13 10 0	- - -
" " 22 g. and 24 g.	14 0 0	- - -
Cut nails, 3 in. to 6 in.....	11 10 0	- - -
(Under 3 in. usual trade extras.)		
LEAD—Sheet, English, 3 lbs. & up.	19 5 0	- - -
Pipe in coils	19 15 0	- - -
Soil Pipe..	22 15 0	- - -
ZINC—Sheet—		
Vieille Montagne ..... ton	26 0 0	- - -
Silesian.....	25 10 0	- - -
COPPER—		
Strong Sheet..... per lb.	0 1 1	- - -
Thin ..... "	0 1 3	- - -
Copper nails ..... "	0 1 3	- - -
BRASS—		
Strong Sheet..... "	0 0 11	- - -
Thin " ..... "	0 1 1	- - -
TIN—English Ingots ..... "	0 1 4½	- - -
SOLDER—Plumbers' ..... "	0 0 7½	- - -
Tinmen's ..... "	0 0 9½	- - -
Blowpipe ..... "	0 0 11	- - -

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2½d. per ft. delivered.
" fourths	2¾d. " "
21 oz. thirds	3½d. " "
" " fourths.....	3d. " "
26 oz. thirds	4d. " "
" " fourths	4½d. " "
32 oz. thirds	5d. " "
" " fourths	5½d. " "
Fluted sheet, 15 oz.	3½d. " "
" " 21 "	4½d. " "
⅛ Hartley's Rolled Plate.....	3d. " "
⅛ " " "	3½d. " "
¼ " " "	4d. " "

OILS, &c.

	£ s. d.	
Raw Linseed Oil in pipes	per gallon 0 2 10	
" " in barrels	" 0 2 11	
" " in drums	" 0 3 1	
Boiled " in pipes.....	" 0 3 1	
" " in barrels	" 0 3 2	
" " in drums	" 0 3 4	
Turpentine, in barrels	" 0 2 8	
" in drums.....	" 0 2 10	
Genuine Ground English White Lead ...per ton	27 0 0	
Red Lead, Dry.....	" 24 10 0	
Best Linseed Oil Putty.....per cwt.	0 9 6	
Stockholm Tar ..... per barrel	1 10 0	

VARNISHES, &c.

	per gallon £ s. d
Fine Elastic Copal Varnish for outside work ..	0 16 6
Best Elastic Copal Varnish for outside work ..	1 0 0
Best Elastic Carriage Varnish for outside work	0 16 6
Best Hard Oak Varnish for inside work	0 10 6
Best Extra Hard Church Oak Varnish for inside work	0 10 6
Fine Hard Copal Varnish for inside work	0 10 6
Best Hard Copal Varnish for inside work	0 16 0
Best Hard Carriage Varnish for inside work....	1 0 0
Extra Pale Paper Varnish	0 16 0
Best Japan Gold Size	0 12 0
Best Black Japan	0 10 0
Oak and Mahogany Stain	0 16 0
Brunswick Black	0 9 0
Berlin Black	0 9 0
Knotting	0 15 0
Best French and Brush Polish	0 10 0

TO CORRESPONDENTS.

NOTE.—The responsibility of signed articles, letters, and papers read at meetings, rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

We are compelled to decline pointing out books and giving addresses.

Any commission to a contributor to write an article is given subject to the approval of the article, when written, by the Editor, who retains the right to reject it if unsatisfactory. The receipt by the author of a proof of an article in type does not necessarily imply its acceptance.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; those relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursdays.* N.B.—We cannot publish tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of tenders accepted unless the amount of the tender is given, nor any list in which the lowest tender is under £100, unless in some exceptional cases and for special reasons.]

* Denotes *accepted.* † Denotes *provisionally accepted.*

DUNSTABLE.—For the construction of sewerage and sewage disposal works, for the Corporation. Mr. W. H. Radford, C.E., Albion Chambers, King-street, Nottingham:—

Hiram Morecroft	£17,500	0	0	Johnson Bros.	£12,516	0	0
Cooke & Co.	16,687	0	0	C. F. Tomlinson	12,400	0	0
Thos. Adams	15,967	0	0	Clift Ford	12,389	0	0
W. Manders	15,587	4	0	W. Cunliffe	12,370	0	0
R. Ballard, Ld.	15,377	0	0	Geo. Bell	12,290	0	0
Geo. Osenton	15,334	0	0	Siddons & Freeman	12,055	0	0
Joseph Young	13,783	0	0	H. H. Barry	11,390	10	0
Geo. Powdrill	13,736	0	0	Bower Bros. West Bridgford*	11,200	0	0
James Dickson	13,498	11	0	Jowett Bros. (withdrawn)	10,443	0	0
Wilkinson Bros.	13,161	0	0				
John Jackson	13,086	14	8				
Nowell & Son	13,000	0	0				

GRIMSBY.—For extension to offices for Messrs. Hewitt Bros., Limited, Tower Brewery, Grimsby. Mr. Herbert C. Scaping, architect, Grimsby. Quantities by Mr. J. Watson, Hull:—

William Ion	£633	8	Gilbert & Kirton	£578	4
H. Marrows	580	0	Thompson & Sons*	550	0

LONDON.—For the pulling-down and rebuilding of shop and premises, No. 901, Old Kent-road, S.E., for Mrs. M. A. Chalk, Caterham, Surrey. Mr. J. Halsted Waterworth, architect and surveyor, 281A, Queen's-road, New Cross Gate, S.E.:—

Sydney R. Best, Brockley* £915 15 0

RAUNDS.—For erecting shops and factory, Raunds, for Mr. W. Lawrence. Mr. H. Knight, architect, Rushden:—

Kettering Co-operative Builders, Limited	£1,405	F. Barlow	£1,255
W. H. Lovell	1,300	R. Marriott	1,248
T. Swindall	1,288	Hacksley Bros.	1,189
Freeman & Son	1,260	J. Lawrence	1,155
		Smith & Sons	1,147

RUSHDEN.—For erecting a factory for Messrs. Skerritt & Co., Sarton-road, Rushden. Mr. H. Knight, architect, Rushden:—

H. Sparrow	£1,313	Freeman & Sons	£1,200
The Kettering Co-operative Builders, Limited	1,257	Thos. Willmott, Jun.	1,199
Geo. Henson	1,224	R. Marriott, Jun.	1,190
Fred Barlow	1,200	Thos. Swindall	1,147
		Wm. Packwood	1,108
		Hacksley Bros.	1,099

SIDCUP (Kent).—For the new children's homes, the Guardians of Greenwich Union have accepted the tender of

Pattinson & Son £104,040

Quantities by Mr. Louis Jacob, New Cross, S.E.

WANSTEAD.—For erecting a pair of semi-detached houses at Wanstead, N.E., for Mr. C. G. Poupard. Mr. S. Jackson, architect, 65, Fenchurch-street, E.C.:—

J. W. Jerram	£3,500	C. North	£2,750
J. B. Hutchins	3,000	J. Joliffe, Wanstead*	2,735

PUBLISHER'S NOTICES.

Telegraphic Address, "THE BUILDER, LONDON."

CHARGES FOR ADVERTISEMENTS.

COMPETITIONS, CONTRACTS, ALL NOTICES ISSUED BY CORPORATE BODIES, COUNTY AND OTHER COUNCILS, PROSPECTUSES OF PUBLIC COMPANIES, SALES BY TENDER, LEGAL ANNOUNCEMENTS, &c. &c.

Six lines, or under ..... 6s. 0d.
Each additional line ..... 1s. 0d.

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Six lines (about fifty words) or under ..... 4s. 6d.
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Terms for series of Trade advertisements, and for front page, and other special positions, on application to the Publisher.

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FOUR lines (about thirty words) or under ..... 2s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

PREPAYMENT IS ABSOLUTELY NECESSARY.

*** Stamps *must not* be sent, but all sums should be remitted by Postal Orders, payable to DOUGLAS FOURDRINIER, and addressed to the Publisher of "THE BUILDER," Catherine-street, W.C.

Advertisements for the current week's issue are received up to THREE o'clock p.m. on THURSDAY, but "Classification" is impossible in the case of any which may reach the Office after HALF-PAST ONE p.m. on that day. Those intended for the Outside Wrapper should be in by TWELVE noon on WEDNESDAY.

ALTERATIONS IN STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same must reach the Office before TEN o'clock on WEDNESDAY MORNING.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, &c. left at the Office in reply to advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

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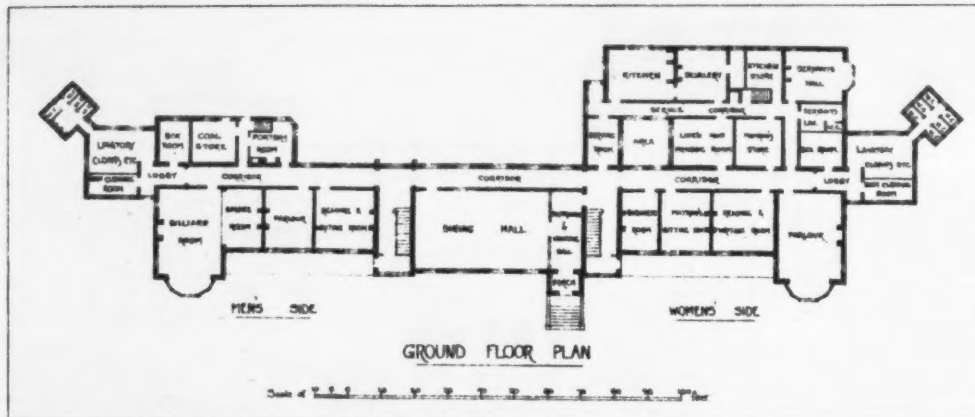

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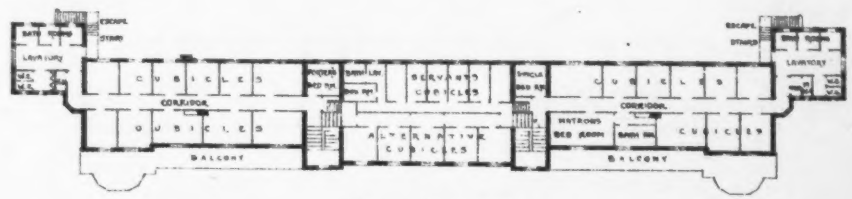

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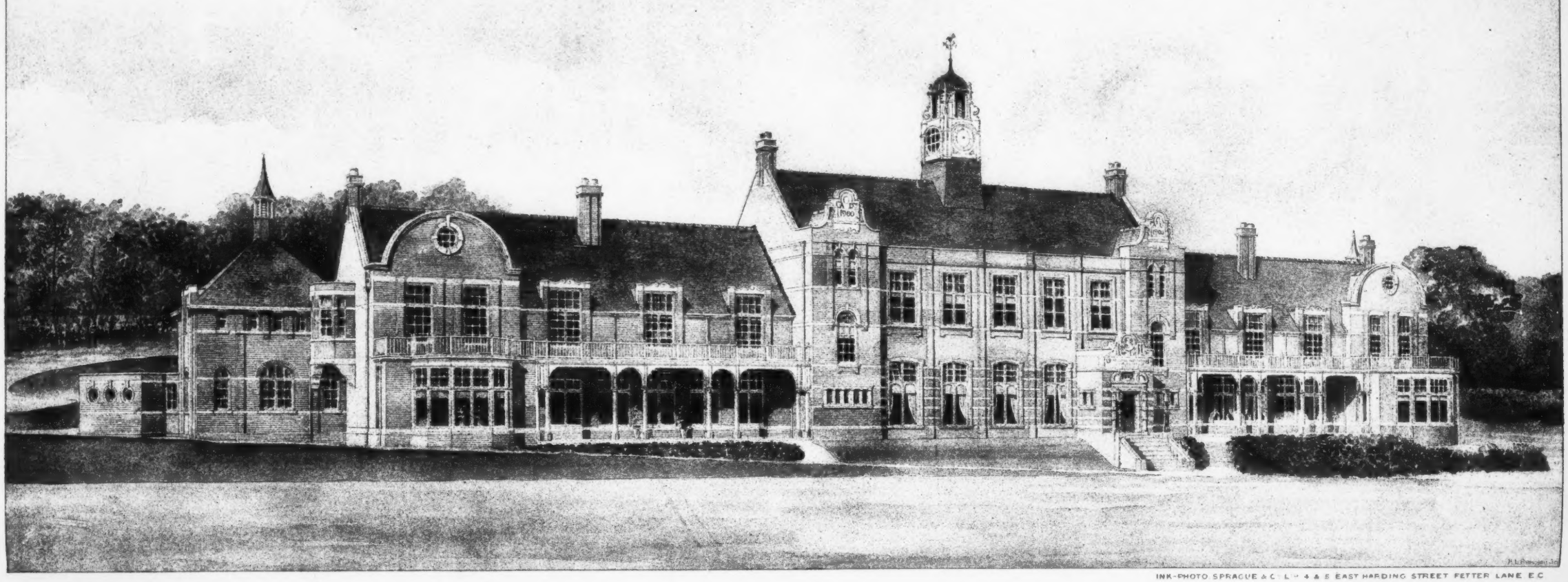

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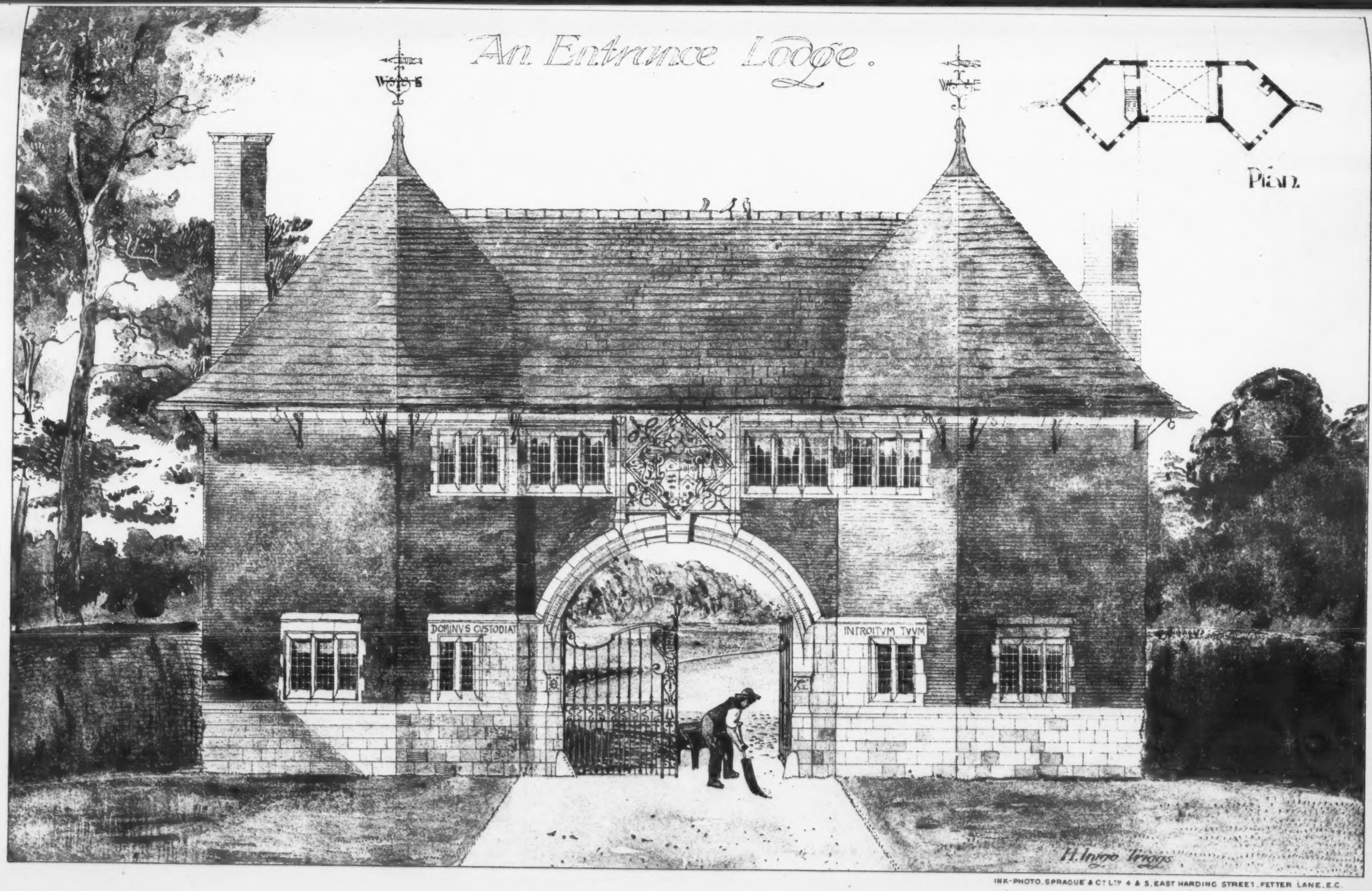

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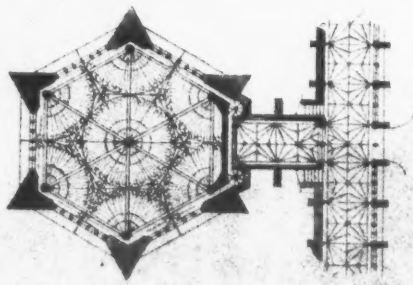

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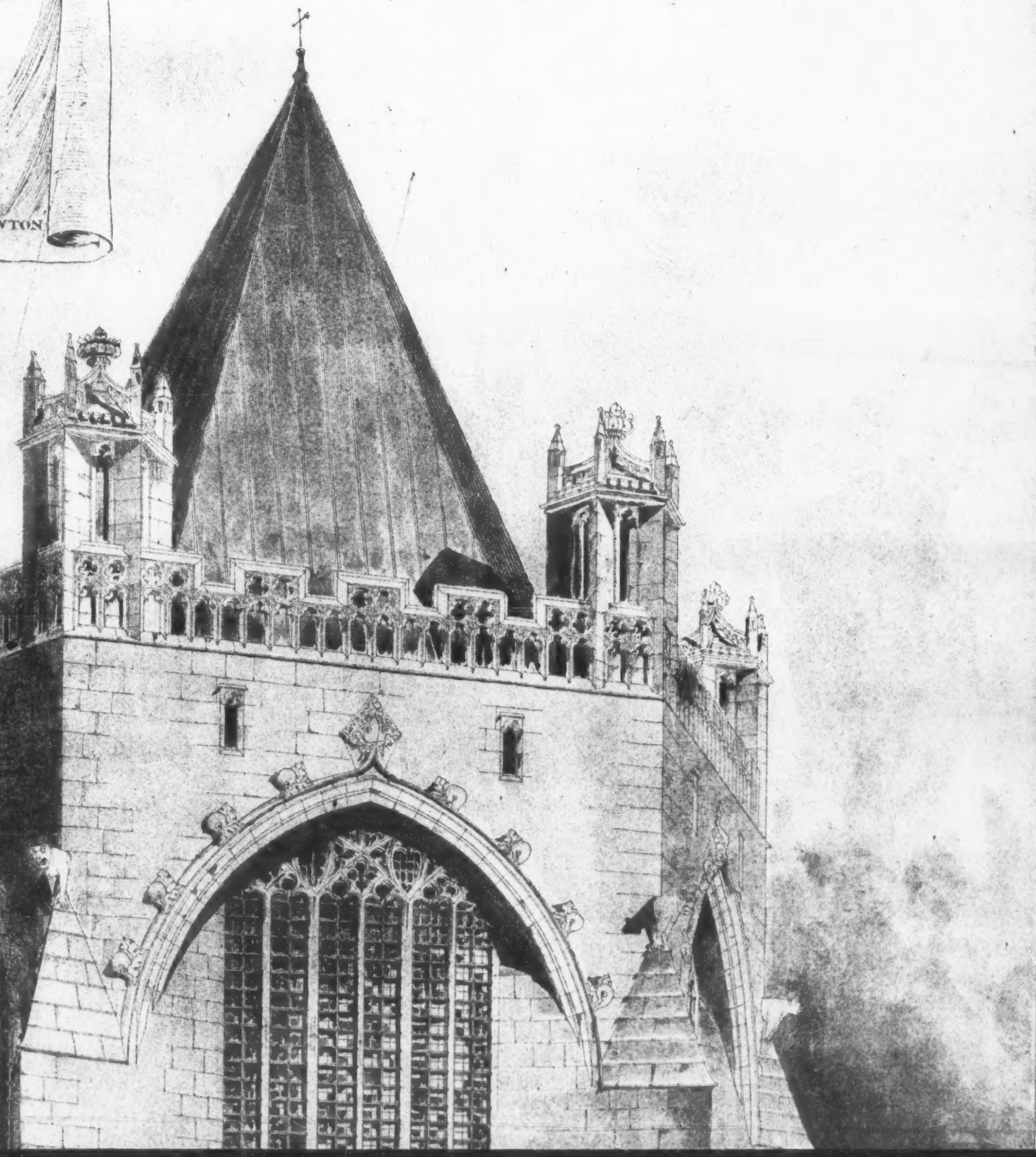

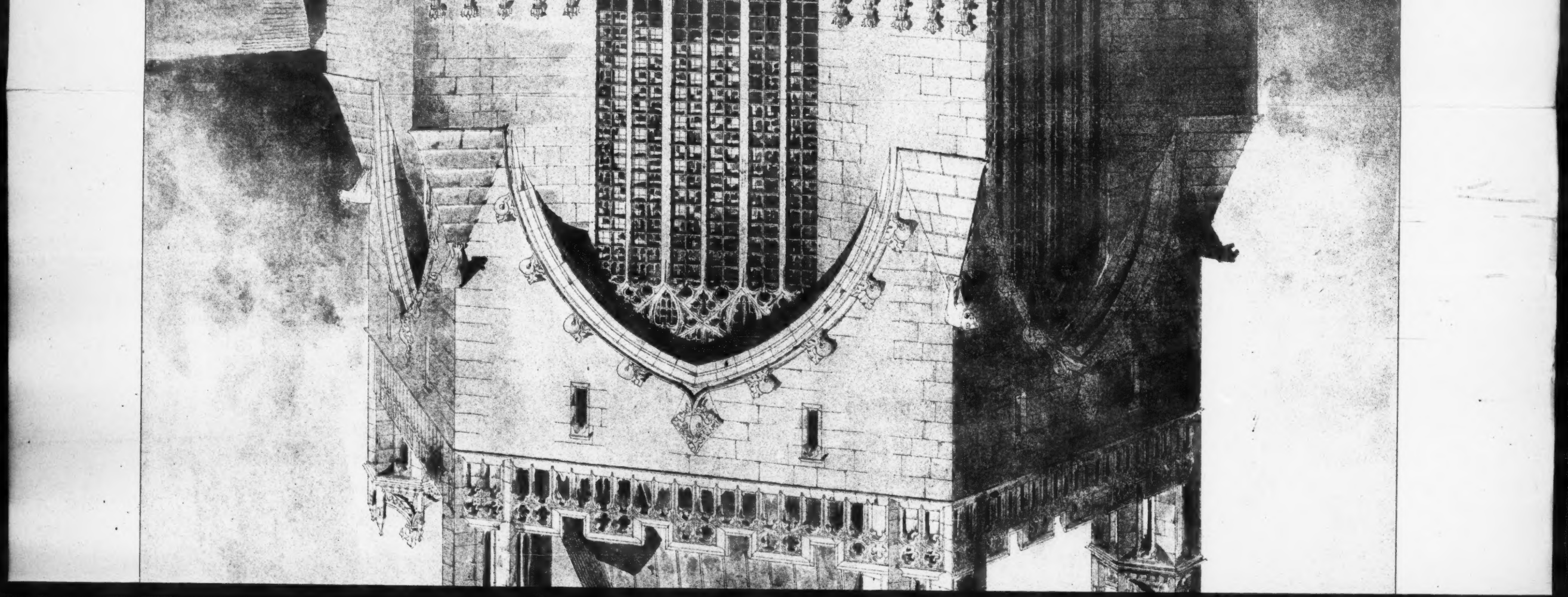

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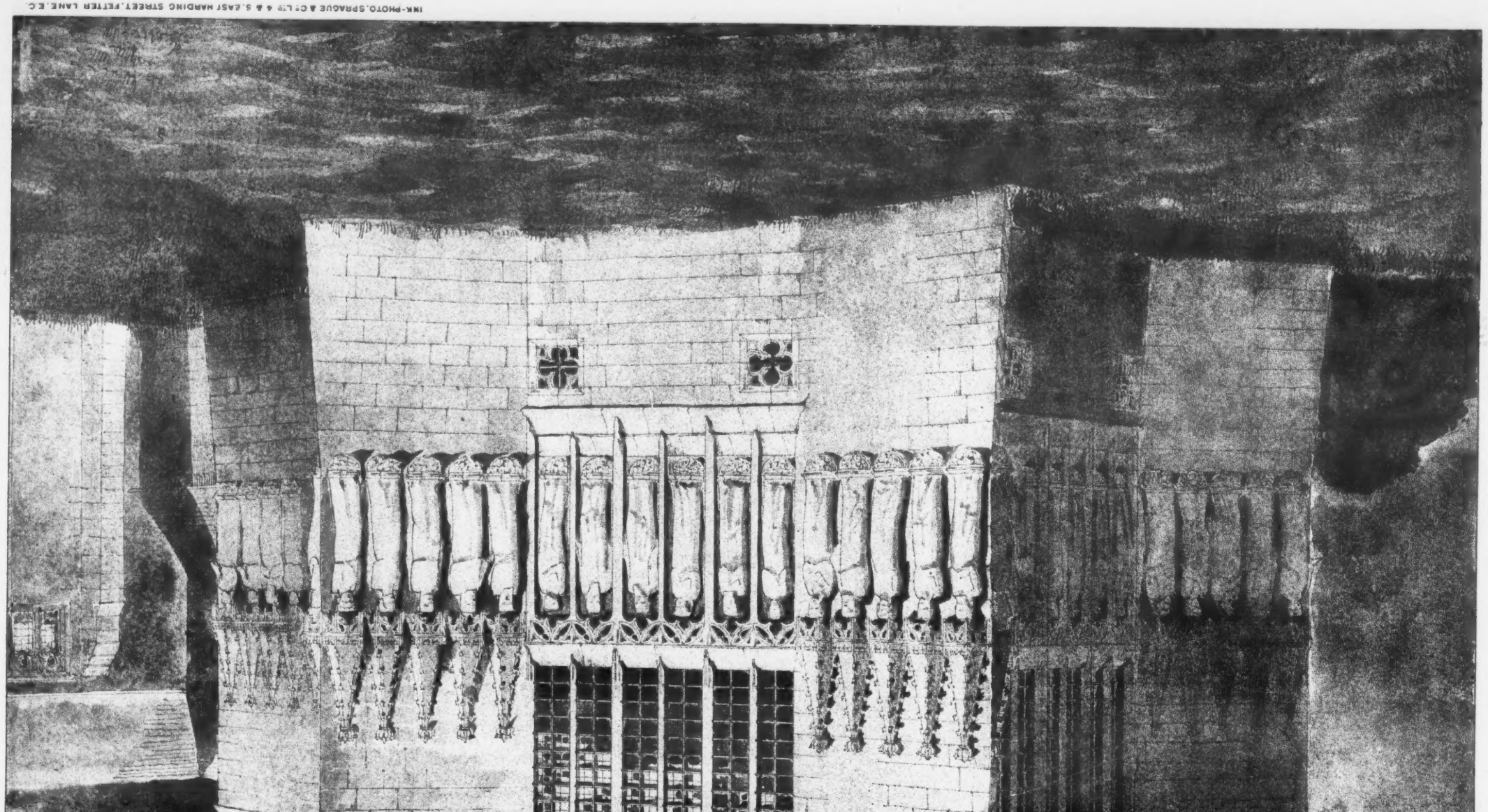

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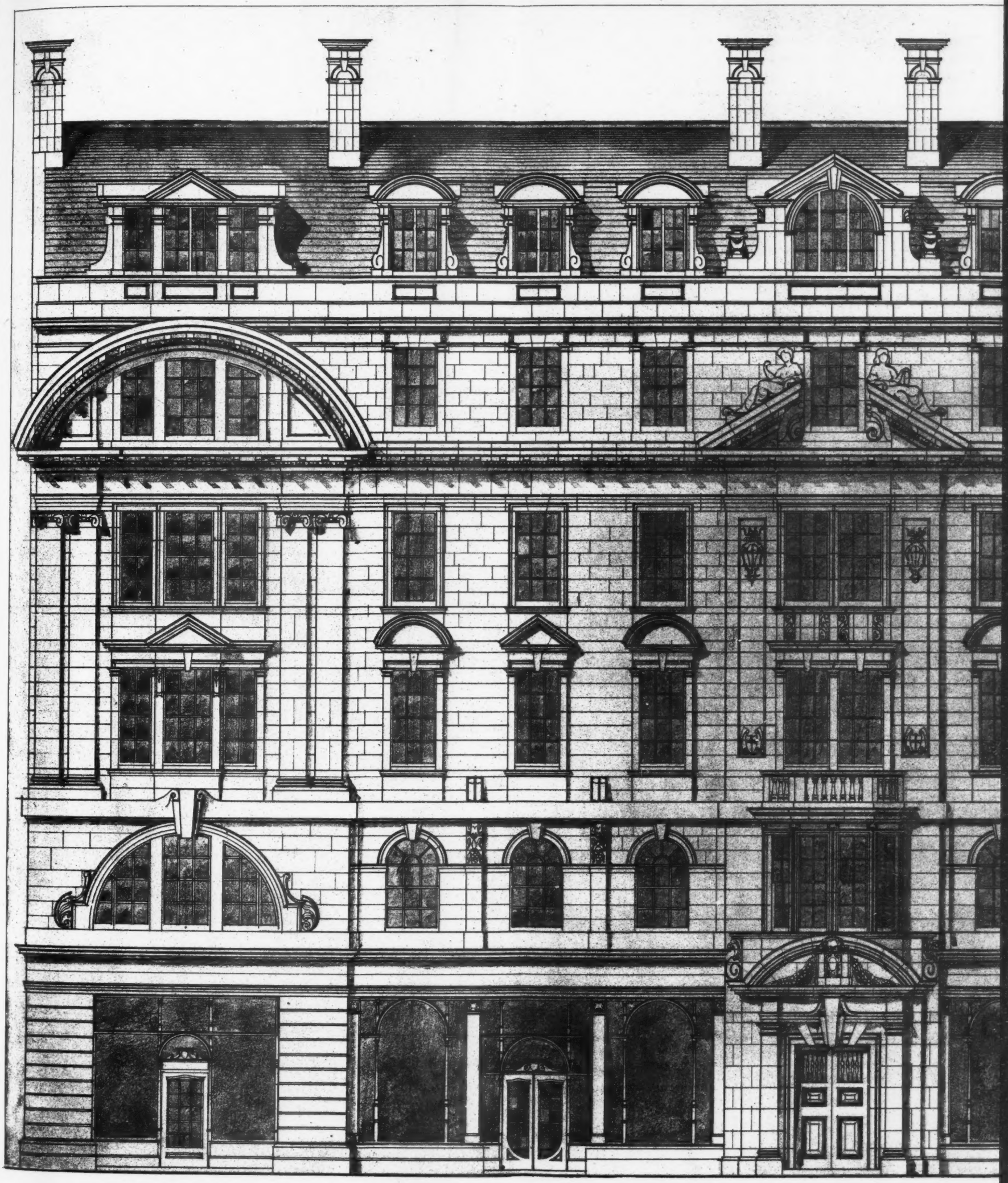

Royal Academy Travelling Studentship, 1900.

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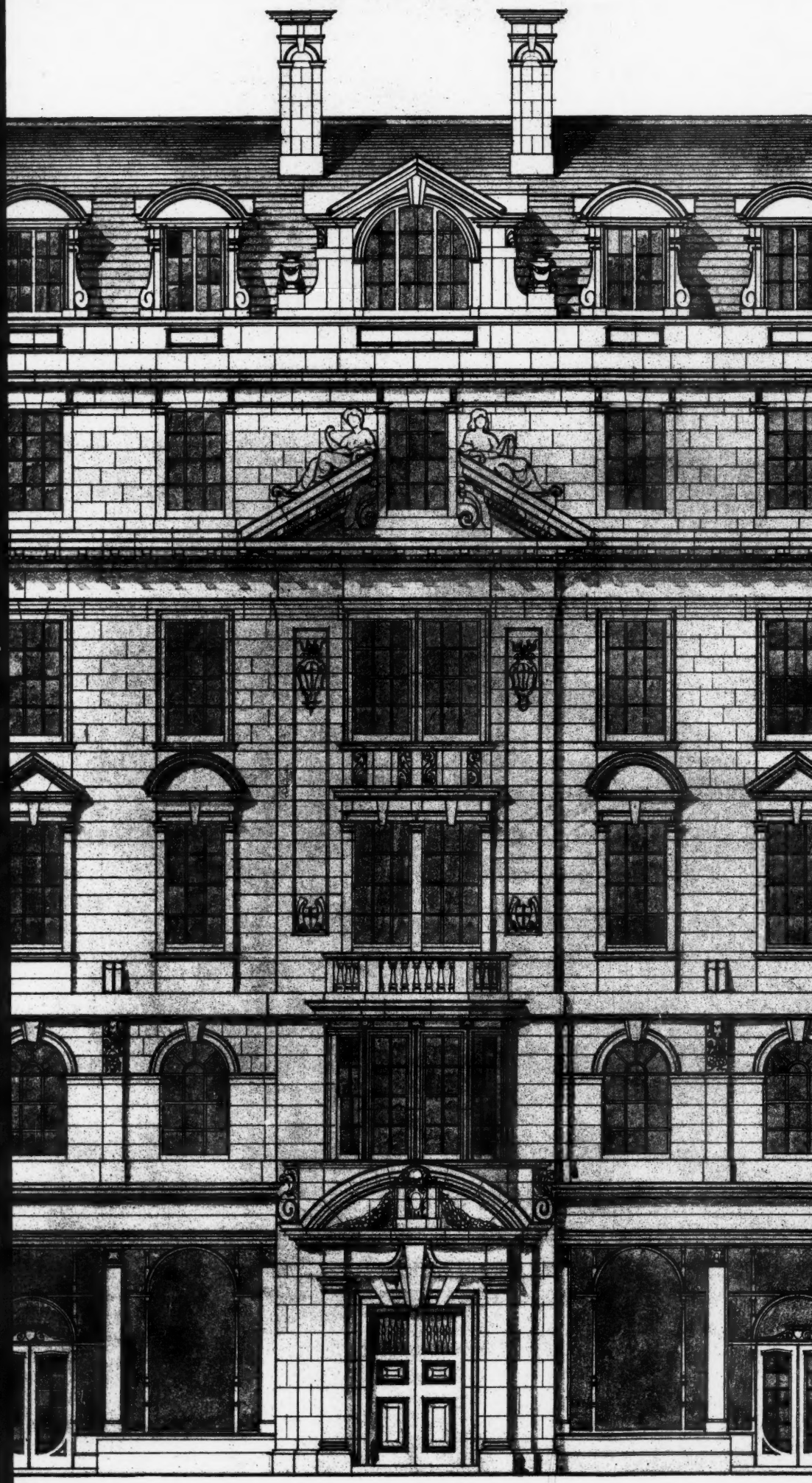

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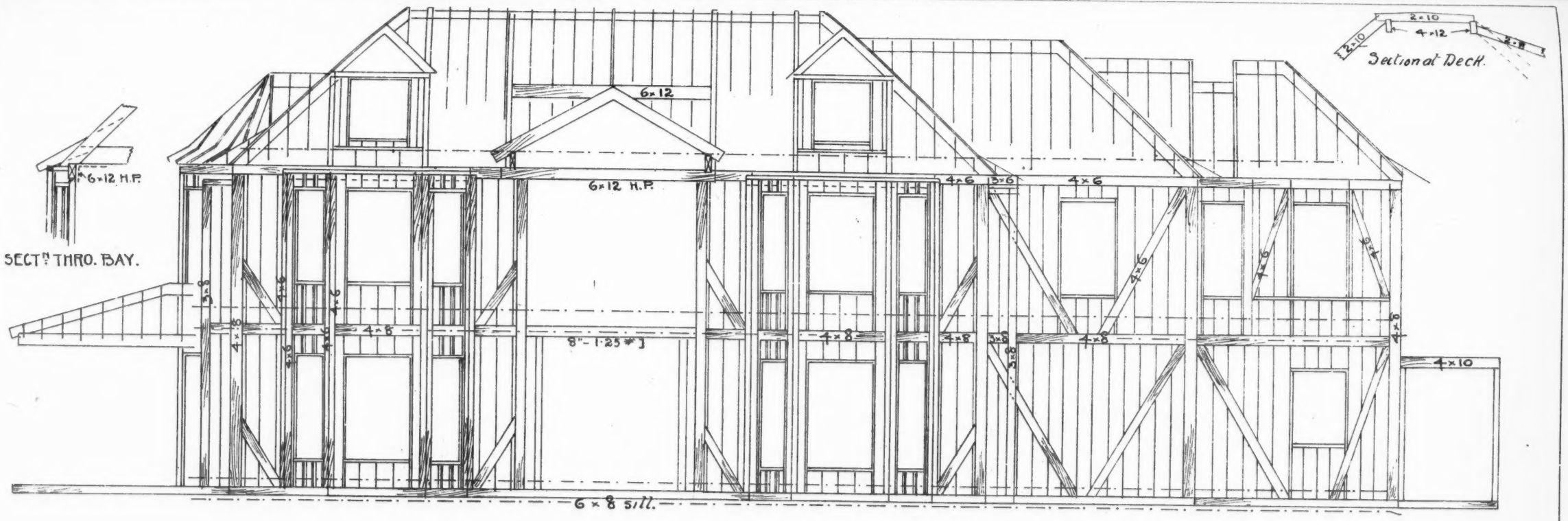

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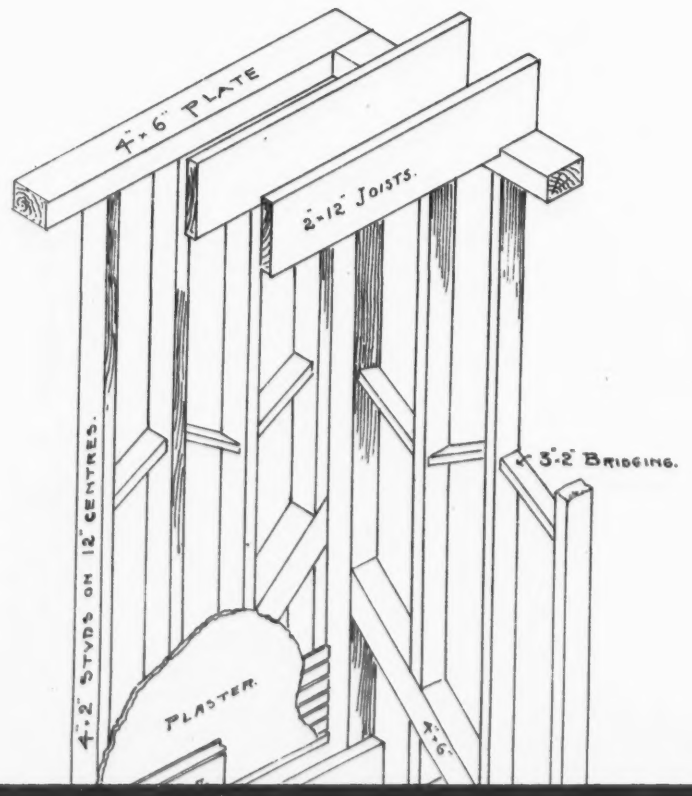

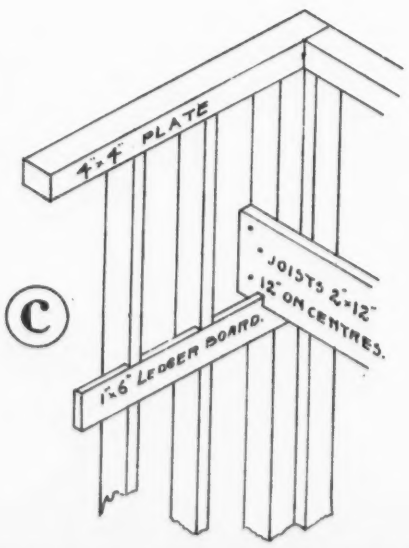

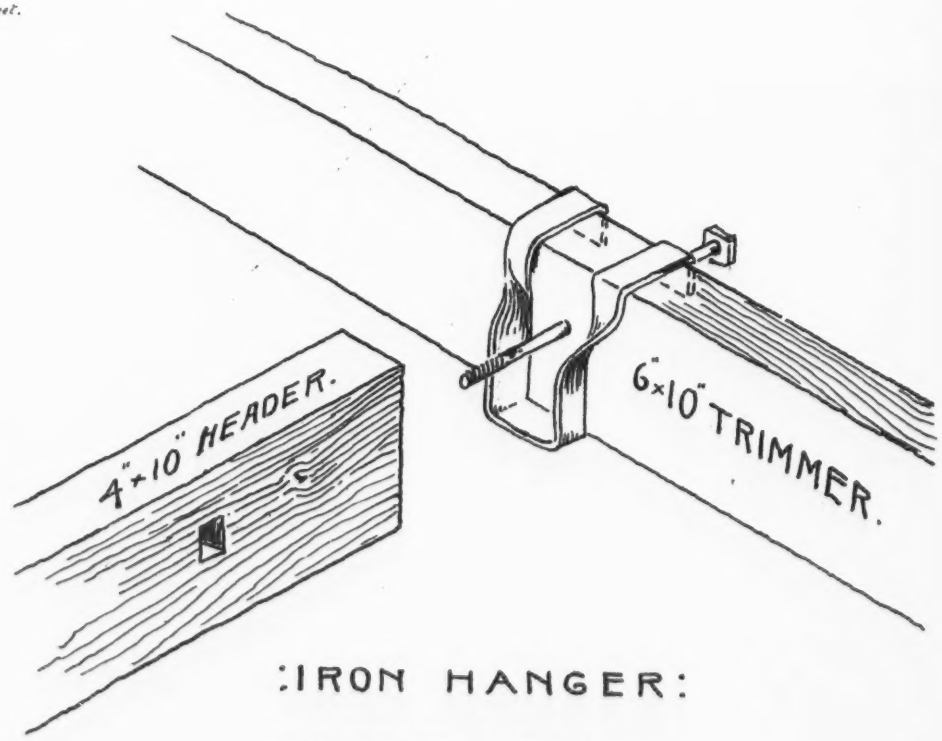

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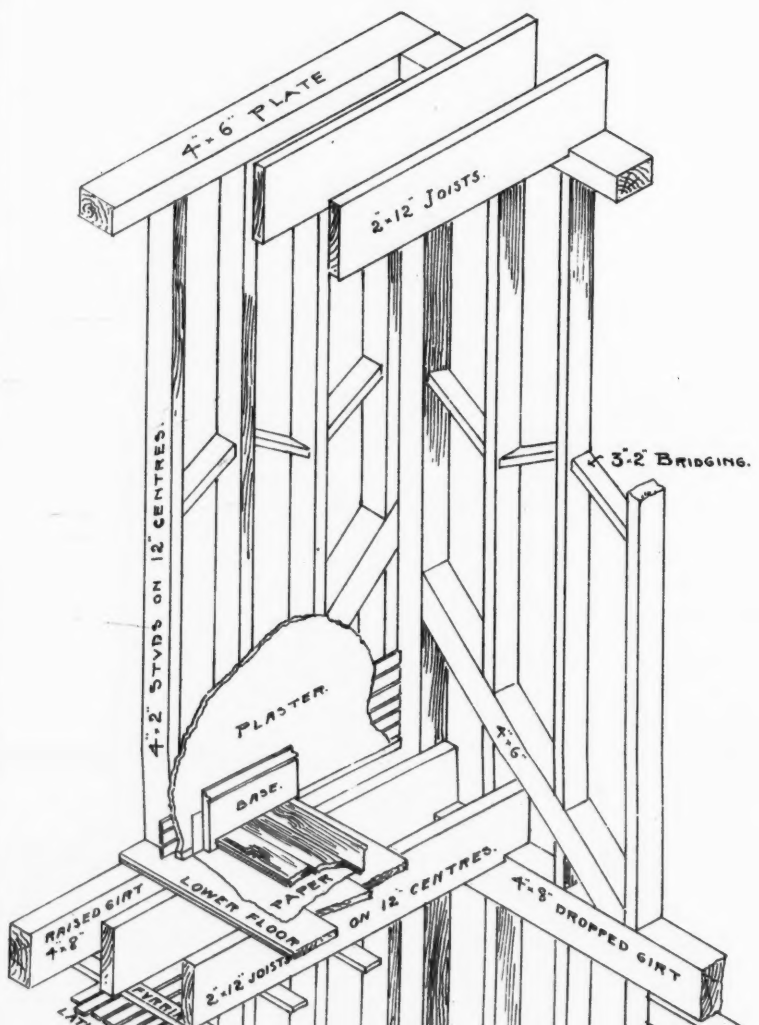

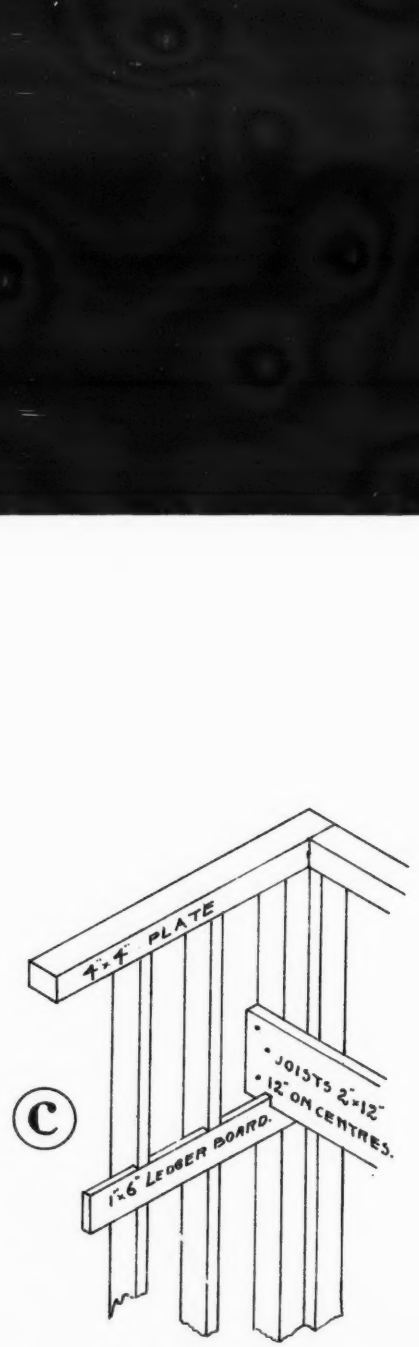

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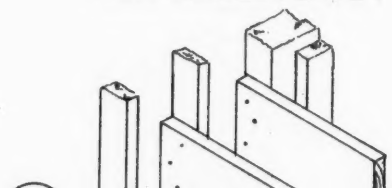

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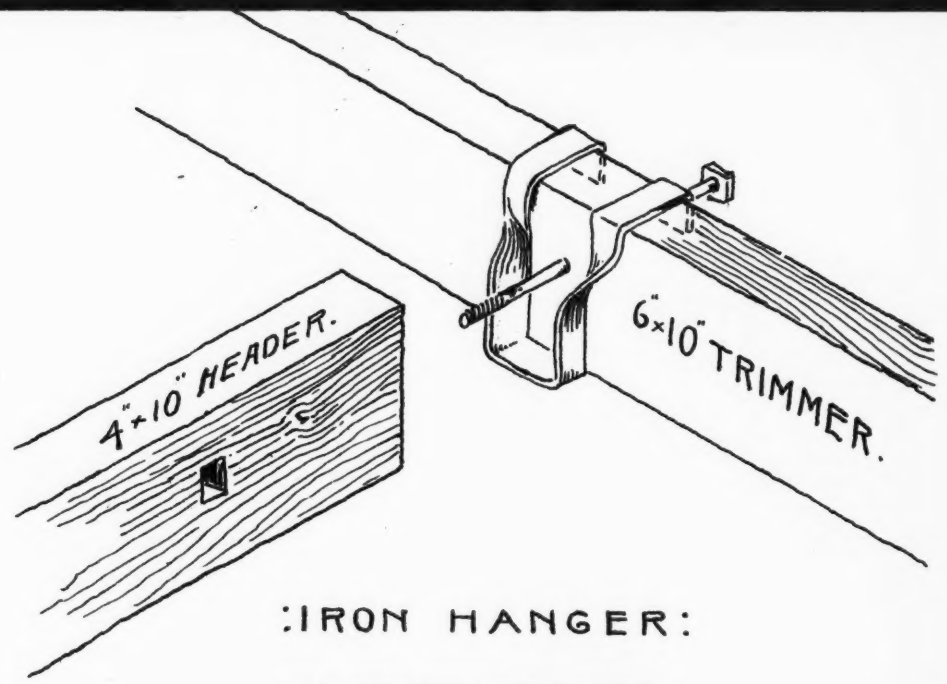

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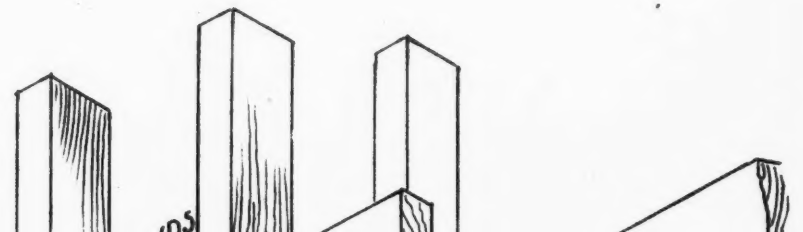

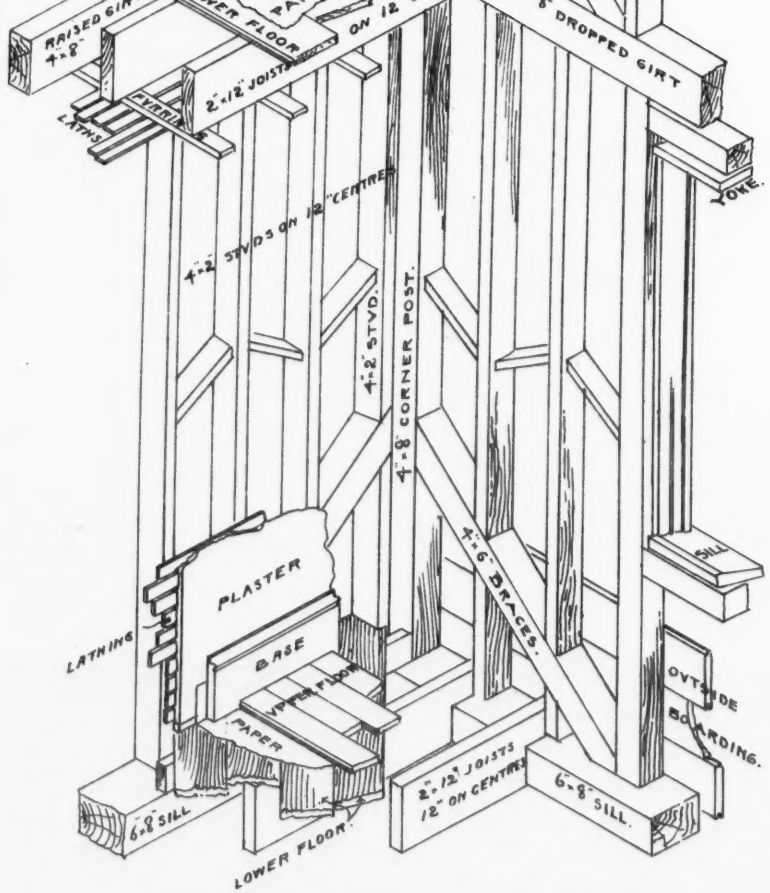

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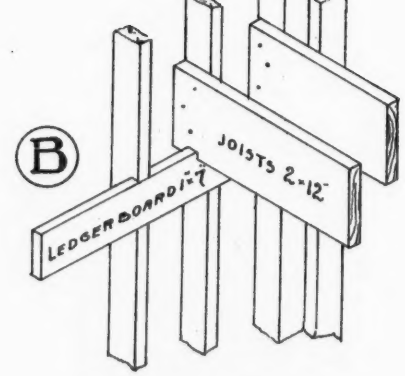

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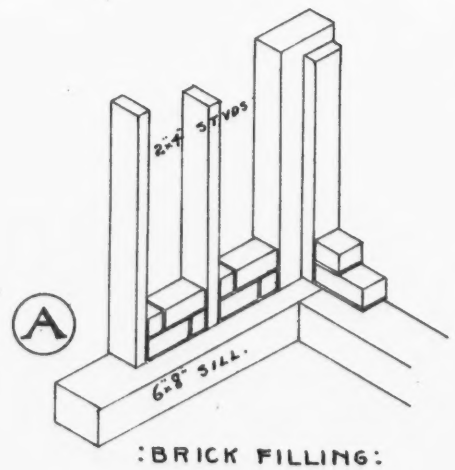

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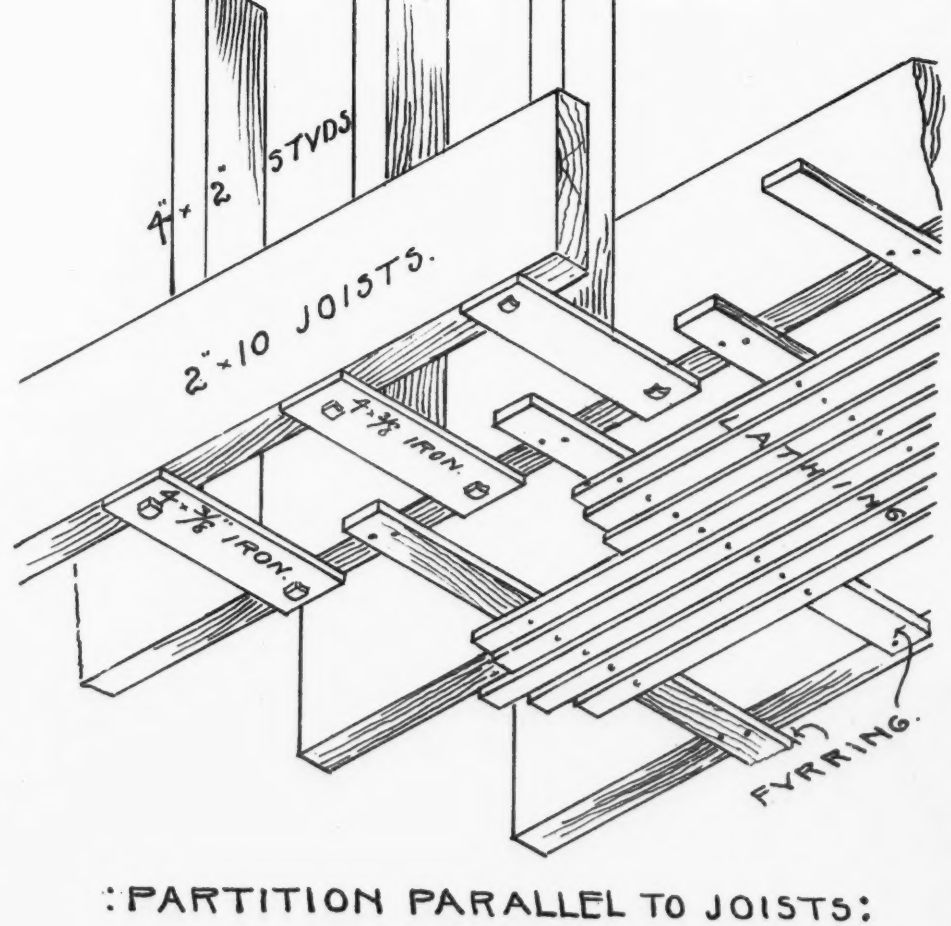

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Accepted 1 March 1971
Published 1 March 1971
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The Builder

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VOL. LXXIX. No. 3021. *Fifty-eighth Year.*

DECEMBER 29, 1900.

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THE ARCHITECTURAL ASSOCIATION

JANUARY 4th.—ORDINARY GENERAL MEETING at No. 9, Conduit-street, W. at 7.30 p.m. Papers by Professor BERESFORD PITE and Mr. E. WEIR SCHULTZ, entitled, "Hints on the Preparation of Studentship Drawings."

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Our "NEW CENTURY" No.

The first "BUILDER" of the 20th Century, to be published on FRIDAY, JANUARY 4th, 1901, will be a very attractive number. Among the Illustrations and original Articles which it will contain may be mentioned the following:—

(a) **An Essay on the genius and works of Sir Charles Barry** (with portrait), illustrated by large reproductions of the original drawings of his great scheme for the concentration of the Government Offices and the Architectural improvement of the Westminster district, and one of an original drawing of Karnac, made on the spot in, or about, the year 1818. Also a View of the Halifax Town Hall, and of the Victoria Tower as seen from the roof of the Houses of Parliament—these latter drawings of two of this great Architect's works have been made by Mr. W. MONK specially for this issue.

(b) **Old Westminster** and its changes during the Century, with views and plans reproduced from old drawings.

(c) **Milton Abbas Abbey.** View, plan and sketches, by Mr ROLAND W. PAUL, with descriptive article, bringing to a conclusion the series of the "Abbeys of Great Britain."

(d) **"The Heart of Rouen,"** a fine characteristic drawing by Mr. H. W. BREWER.

(e) **Newgate Prison,** shortly to be demolished—drawn by Mr. W. CURTIS GREEN.

(f) **The smaller Fine Art Palace on the Champs Elysees, Paris.** Views of the Front and of the Interior Court from Photographs, specially taken.

(g) **"The Portal of the New Century,"** by THE EDITOR.

&c. &c.

From the above list it will be seen that the contents—Artistic as well as Literary—will be so varied, that the number must necessarily appeal to a very wide circle.

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The Commissioners of H.M. Works and Public Buildings are prepared to receive TENDERS for the ERECTION of a POSTMEN'S OFFICE at Clapham, S.W.

Drawings, specification, and a copy of the conditions and form of contract may be seen on application to Mr. J. WAGER, at H.M. Office of Works.

Bills of quantities have been prepared for the use of builders by Messrs. GRITTEN & SON, of 8, Princes-street, Westminster, and together with forms of Tender may be obtained at the undermentioned Office on payment of One Guinea. The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions specified below.

The Commissioners do not hold themselves responsible for the accuracy of the quantities, nor do they bind themselves to accept the lowest or any Tender.

Tenders are to be delivered before TWELVE o'clock noon on TUESDAY, the 15th proximo, addressed to The Secretary, H.M. Office of Works, &c. Storey's Gate, London, S.W. and endorsed "Tender for Clapham Sorting Office."

H.M. Office of Works, &c.
December 22nd, 1900.

THE URBAN DISTRICT COUNCIL of WHITBY.

BUILDINGS FOR ELECTRIC LIGHT STATION.

The Urban District Council of Whitby are prepared to receive TENDERS for the ERECTION of an ELECTRIC LIGHT STATION and DESTRUCTOR.

General conditions, form of Tender, and bills of quantities can be obtained on and after TUESDAY, 1st JANUARY, 1901, and drawings can be inspected on application to the Clerk at the Offices of the Council, Whitby.

Tenders upon printed forms, and endorsed "Electric Light Station, to be delivered at the Offices of the Council, not later than TWO o'clock on TUESDAY, the 8th JANUARY, 1901.

A 10*l.* to be enclosed with each Tender, which will be returned to all unsuccessful contractors immediately Tenders are accepted.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
WM. SEATON GRAY,
Clerk to the Council.

Offices,
Whitby, Yorks.

[*See also page* vi.

COPPER ROOFING

As Economical as Lead.

For Flats, Towers, Domes, Flêches, Mansards,

—&c.—

EWART & SON, LONDON.

J. CONSTANTINE & SON'S CONVOLUTED STOVE

Is the Most Powerful and Efficient Air-Warmer now in use.

NO FAILURES WITH THIS APPARATUS.

The Royal Exchange and Free Trade Hall, Manchester, have been easily and efficiently warmed by this apparatus for over 20 years.

For Estimates and Plans of

WARMING ARRANGEMENT for CHURCHES, CHAPELS, SCHOOLS, PRIVATE HOUSES, and TURKISH BATHS,

Apply to **J. CONSTANTINE & SON,**
CONVOLUTED STOVE WORKS.

STOCKTON-ST. CLARENDON-ST.; or 23, OXFORD-ST., MANCHESTER.

A. PEARCE,
Contractor, 12, BELVEDERE-SQUARE, CHURCH-ROAD, WIMBLEDON.

BUILDER'S MATERIALS SUPPLIED, such as SAND, BALLAST, BRICKS, ASHES, BREEZE, &c. Horses, Carts, or Vans by Day or Job. Furniture Removed. Apply at above address.

The Anaglypta Branch of The Wall Paper Manufacturers Ld. are Patentees and Makers of

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THE CHEAPEST SUBSTANTIAL RELIEF DECORATION.

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CROCCON & CO.

(LIMITED),

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— LONDON, E.C. —

And at LIVERPOOL and GLASGOW.

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PUBLIC BUILDINGS, PRIVATE HOUSES, MANSIONS, FACTORIES, &c.

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"PERFECTION SYSTEM"

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THE LION, made of Steel, with Steel Lattice-work Tower; also the **HALLADAY,** with Wooden Fans, for Pumping from Deep or Shallow Wells, and for Driving Dynamos and Sewage Pumps.

TRIAL BORINGS.

PUMPS OF ALL DESCRIPTIONS.

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Alfred Williams & Co.,

Hydraulic Engineers. Contractors to H.M. Govt.

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PUMPING PLANT AND FIRE MAINS.

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AND GIVE

BEST SCHEMES. LOW ESTIMATES.

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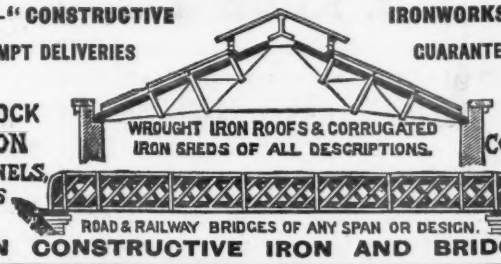

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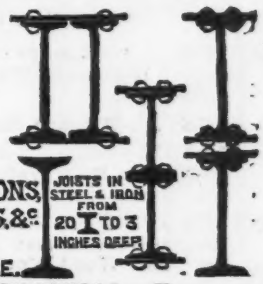

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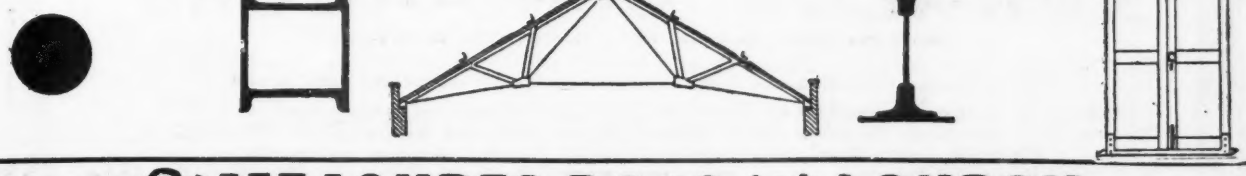
Telegraphic Address—"Expansion, London." *Telephone No. 784 Holborn.*

RICHARD MORELAND & SON, Ltd.

ENGINEERS, OLD STREET, LONDON, E.C.

SOLID-STEEL COLUMNS. STEEL STANCHIONS. STEEL ROOFS. STEEL GIRDERS. FIRE-RESISTING DOORS.



MEASURES BROS. Ltd. LONDON.

10,500 TONS SIEMENS-MARTIN ENGLISH STEEL JOISTS
BESSEMER FOREIGN STEEL JOISTS
3 to 20 inches deep. *Always in Stock.*

TEES, ANGLES, CHANNELS, CHEQUERED PLATES, CASTINGS, of Every Description for Building Work.

SECTION SHEETS AND ESTIMATES ON APPLICATION.

Prompt Delivery from Stock.

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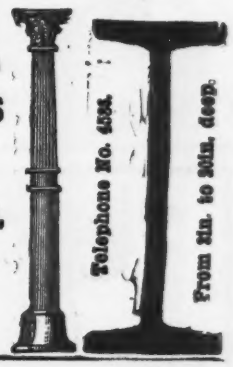

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Offices and Works—15, NORTH WHARF, PADDINGTON.

Telephone No. 74, Paddington. Telegraphic Address, "Troughing, London."

RIVETED GIRDERS, BRIDGES, FLITCH PLATES, L's and T's,
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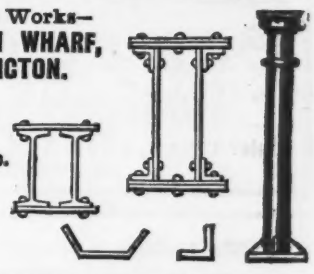
PATENT WROUGHT-IRON SASHES.

— *Deliveries from Town Stock.* —



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ARCHIBALD D. DAWNAY & SONS, LIMITED,

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FOREIGN IRON AND STEEL JOISTS AND GIRDERS
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NEW CATALOGUE,

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SAVE YOUR COALS.

TESTIMONIALS

FOR OUR CELEBRATED

"SINE QUA NON" RANGE.

Estate Office, Southill Park, Biggleswade

Dear Sirs,—The **"Sine Qua Non" Range** exceeds my expectation. The consumption of coal is less than one-half and the cooking capacity double compared with the old one.

Faithfully yours,

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Head Office & Show Rooms: 11, 12, 13, & 14, BURY ST., St. Mary Axe, London, E.C. *Works:* Farringdon Wharf, Stratford, E. and Bow Bridge Ironfoundry, E. *Branch Establishments:* 119, Victoria Street, and Canynge Street, Bristol; and Weston Chambers, Southend.

LIGHTNING CONDUCTORS

IN PATENT COPPER ROPE OR TAPE.

OLD AND COSTLY METHOD OF TESTING

NEWALL'S CONDUCTORS

Are the most reliable, most effective, and cheapest offered to the public.

Sole Manufacturers of Vyle's Patent (Easily Tested) Lightning Conductors. Fixed Complete by experienced workmen and their efficiency tested by competent electricians.

Makers of Every Description of Superior Quality Manilla Fall Ropes, Scaffold Cords, Patent Non-Rotating Flexible Steel Crane Ropes, Gilt and Silver Cord for Hanging Pictures, Iron, Steel, and Copper Cord for Clock and Sash Lines, &c.

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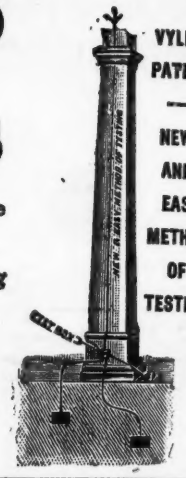

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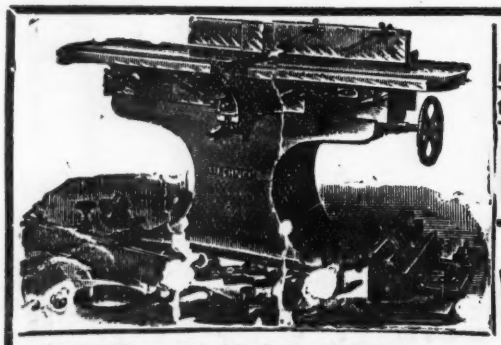
DIXON & CORBITT and R. S. NEWALL & CO., Ld.

Offices—130, STRAND, W.C.

London Stores:—130, STRAND, W.C., and 73, GARFORD STREET, E.



Chief Offices, 21, 23, & 25, TABERNACLE ST., LONDON, E.C.

800-1,000 Machines kept in stock.

Highest References throughout the United Kingdom.

KIRCHNER & CO

The Largest Makers in the World of

WOODWORKING MACHINERY.

CRANE REPAIRS.

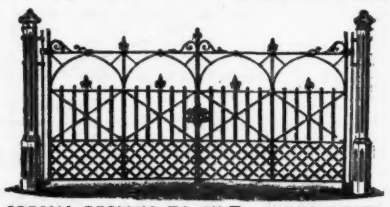
TRACY & GOZZARD,

Kent Wharf, Great Cambridge-street, London, N.E. and MARKET PLACE, ROMFORD.

Telegrams: "Derrick," Romford

HILL & SMITH

ENTRANCE AND PARK GATES.



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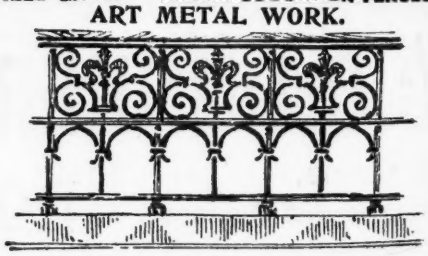

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UNCLIMBABLE RAILING.

SEND FOR ILLUSTRATED CATALOGUES AND PRICES. Free on Application.

Brierley Hill Iron Works, Staffordshire.

118, QUEEN VICTORIA ST., LONDON, E.C.

47, DAWSON STREET, DUBLIN

REPLIES REFER TO THIS ADVERTISEMENT.

CONTRACTS (*continued from p.* iv.)

METROPOLITAN ASYLUMS BOARD.

TO BUILDERS.

The Metropolitan Asylums Board invite TENDERS for the ERECTION of a SCHOOL for CHILDREN at Swanley, Kent, according to drawings, specification, articles of agreement, and schedule of conditions, which may be seen at the Offices of the Architects (Messrs. NEWMAN & NEWMAN), 31, Tooley-street, London Bridge, S.E. between TEN and FIVE. Bills of quantities, prepared by Messrs. W. H. & P. B. STRUDWICK, may be obtained at the Office of the Architects, as above, upon payment of a deposit of 10*l.* in gold or Bank of England notes, which amount will be returned to persons sending in a bonâ-fide Tender. Tenders, sealed and endorsed "Tender for Erection of White Oak School," and accompanied by original priced bills of quantities in separate sealed packets, must be delivered at the Office of the Board, Embankment, E.C. not later than TEN a.m. on WEDNESDAY, JANUARY 30th, 1901.

The Board do not bind themselves to accept the lowest or any Tender.

By order,
T. DUNCOMBE MANN,
Clerk to the Board.

December 22nd, 1900.

TO BUILDERS.

The Metropolitan Asylums Board invite TENDERS for ALTERATIONS and ADDITIONS to LAUNDRY MACHINERY and FITTINGS, at St. Anne's Home, Herne Bay, Kent.

A copy of the conditions of contract, plan, specification, and form of Tender may be obtained at the Office of the Board (corner of Carmelite-street), Embankment, E.C.

The Tender must be upon the form issued by the Board, enclosed in a sealed envelope, and endorsed "Tender for Laundry, St. Anne's Home," addressed to the Clerk of the Board, and delivered at the Office of the Board by TEN a.m. on THURSDAY, 17th JANUARY, 1901.

The Managers do not bind themselves to accept the lowest or any Tender.

By order,
T. DUNCOMBE MANN,
Clerk to the Board.

December 24th, 1900.

[*See also page* viii.

JOHN BELLAMY, Limd.

BYNG STREET, MILLWALL, LONDON, E.

WROUGHT-IRON

TANKS AND CISTERNS

Of any shape or size, for hot or cold water, to drawings or specifications.

IRON DOORS, SMOKE-PIPES AND FUNNELS, TROUGHS, CORN-BINS, &c.

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LONDON GALVANISED IRON CO.

No. 27, WHARF ROAD, LONDON, N.

Tank Works—Druid-street, Bermondsey, S.E.

WROUGHT IRON TANKS & CISTERNS GALVANISED AND PAINTED.

20 to 1,000 Gallons always in stock. Manufacturers of Sanitary Dust-Bins. Every description of Ironwork Galvanised. Communications to be addressed, 27, WHARF-ROAD, CITY-ROAD. Telegraphic Address "DIENEL, LONDON."

OVER 900 FIXINGS, NOT ONE ACCIDENT.

EMPLOYERS' LIABILITY

Reduced to its Lowest Point by using

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(Wire Supported)

TRAVELLING CRADLE.

USED BY THE LONDON COUNTY COUNCIL.

Is absolutely the Safest and Easiest means of reaching all work where staging or ladders are required.

FIXINGS SHOULD BE INCLUDED IN BUILDING PLANS.

Consultations and Estimates Free.

NO INTERFERENCE WITH ROOF OR PAVEMENT OBSTRUCTION.

CAN BE FIXED ANYWHERE.

HIGHLY COMMENDED by the ENTIRE "TRADE" PRESS.

ENQUIRY INVITED FOR SPECIAL OR DIFFICULT STAGING.

Inventor and Patentee } **EDWIN PALMER, 250, Westminster Bridge Road, S.E.**

Telephone No. 1,156, "Hop." Telegrams, "Wireway, London."

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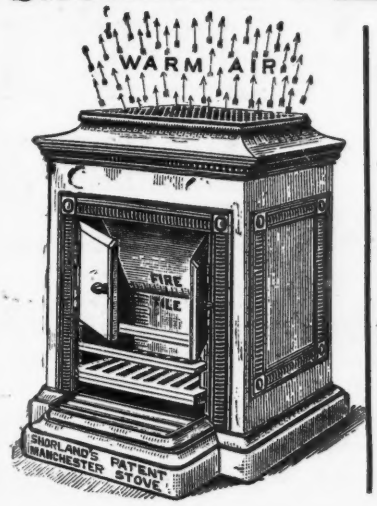

SINGLE and DOUBLE FRONTED.

Largely in use in . .

HOSPITAL WARDS

. . throughout the Kingdom.

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ROOF VENTILATORS.

E. H. SHORLAND & BROTHER

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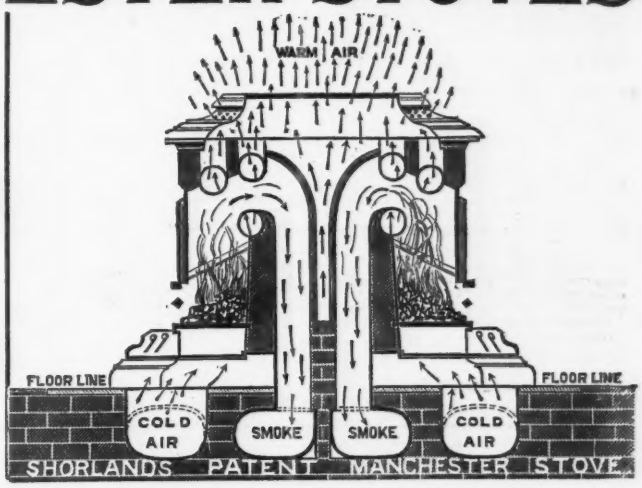
MANCHESTER.

Telegrams—WARMING, Manchester.
Nat. Telephone—No. 2188.



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For mixing with **COMMON LIME PLASTER.** XELEX mixed with Common Lime Plaster makes **PERFECT WORK,** with **GREAT RAPIDITY** and with **ECONOMY.** Two coats only are required, and the second may be applied within twenty-four hours. The total thickness need not be more than ¾-in., thus saving much material. It is the best Plaster for Iron Lathing. It is adhesive and tough, and does not rust the ironwork.

For further particulars and Prices in London apply to—

THE DORKING GREY STONE LIME COMPANY, Ltd.,

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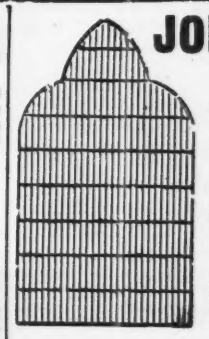


JOHN CLARK, LTD.

BLOOMSBURY BRASS AND WIRE WORKS,

46 & 47, HIGH STREET,

NEW OXFORD STREET, W.C.

Manufacturer of every description of useful and ornamental

WIREWORK

SIEVES, LIME SCREENS, DESK RAILS, LIFT ENCLOSURES, BRASS FENDERS, &c.

Special Low Quotations for Wirework for the Protection of Windows and Skylights. Price Lists and Illustrations post free on application. Estab. 1855. Tele. Address: "Pheasantry, London."

WALL TIES.

WROUGHT, 500 IN 1 CWT.

WROUGHT, 300 IN 1 CWT.

Illustrations, Prices, & Numbe to the Cwt. of eleven different patterns on application to

NOYES & CO

76, Old St.

LONDON.

FOR THE INTRODUCTION OF FRESH AIR THROUGH AN EXTERNAL WALL.

PRICE LISTS ON APPLICATION.

HAYWARD BROTHERS & ECKSTEIN

LIMITED,

192, UNION STREET, BOROUGH, S.E.

NOTICE OF REMOVAL.

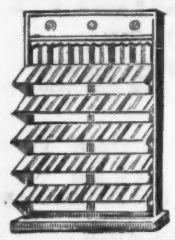
The "B & S" FOLDING GATE CO.

Beg to give notice that, owing to the continued increase of their business, they have been obliged to remove from their late address, 20, John-street, Adelphi, W.C., and have taken the entire building

19, 20, & 21, TOWER STREET,

Upper St. Martin's Lane, LONDON, W.C.

Patent Folding Gates, Lifts,
Ornamental Wrought Iron Work,
Lift Enclosures,
Screw Pumps, Interlocking Rubber Tiling,
Hindley Worm and Gears.



The "HELIOSCENE" Blind.

SPECIALLY SUITABLE FOR HOTELS, & is the only Outside Blind combining free view with perfect ventilation. Messrs. LOWTHER & CO. the original Patentees, now incorporated with the above.

THE KENSINGTON BLIND WORKS, LONDON, W.

MANUFACTURERS OF INSIDE AND OUTSIDE

WINDOW BLINDS

of every description, at the Lowest Possible Prices for Best Quality Work.

ESTIMATES AND DESIGNS FREE ON APPLICATION.

ALBERT J. SHINGLETON, 110 and 112, KENSINGTON HIGH ST. LONDON, W.

Factory: BRIDGE ROAD and BLACK'S ROAD, HAMMERSMITH, W.

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Telegrams: "BLINDS, LONDON."

SPECIALITY Blinds for Offices and Banks.

Largest exclusive Manufacturers in the United Kingdom.

TELEGRAMS, NORSELEY, TIPTON. CALILEO, LONDON.

London Office— 11, VICTORIA-ST.

THE HORSELEY Co. Ld.

TIPTON, Staffs.

Passenger Station— DUDLEY PORT.

ENGINEERS AND IRONFOUNDERS

Estimates on Application.

Makers of LAMP PILLARS; STEEL ROOFS, STEEL SASHES, STEEL, WROUGHT, & CAST-IRON GIRDERS, EVERY DESCRIPTION OF BUILDERS' IRONWORK.

CONTRACTS (*continued from p.* vi.).

HORNSEY URBAN DISTRICT COUNCIL.

TO SEWER CONTRACTORS AND OTHERS.

The Hornsey Urban District Council are prepared to receive TENDERS for the CONSTRUCTION of about 3 500 ft. run of BRICK STORM-WATER CULVERT varying from 3 ft. to 6 ft. in diameter, and about 550 ft. run of 12-in. STONEWARE PIPE SEWER with Bellmouths. Side Entrances, Manholes, &c at Hornsey (from the foot of Muswell Hill, along Priory-road, through Rectory Grounds to Pembroke-road).

Plans and specifications may be seen, and copies of the quantities and forms of Tender and all information obtained, on application to Mr. E. J. LOVEGROVE, Engineer to the Council, at the Offices mentioned below, on any morning between the hours of TEN and TWELVE o'clock, on a sum of 2*l.* being deposited with the Clerk to the Council, which sum will be retained by the Council, and deemed to be forfeited if a bonâ fide Tender is not made by the depositor.

If a Tender is made which is not accepted, the sum deposited will be returned, and if a Tender is accepted, such sum will be retained by the Council until the Contract has been executed by the depositor, and will be forfeited in the event of his or his sureties failing or neglecting to execute such Contract, or the bond accompanying the same, within seven days after he or they respectively shall have been requested to execute the same.

No Tender will be considered except on the prescribed form. Sealed and endorsed Tenders are to be delivered or sent by post so as to be deposited in the Tender box in my department not later than FOUR o'clock p.m. on MONDAY, the 21st day of JANUARY proximo. The quantities, duly completed, must accompany the Tenders.

The Council reserve to themselves the right to decline all or any of the Tenders so sent in.

By order,
F. D. ASKEY,
Clerk to the District Council.

Offices: Southwood-lane, Highgate, N.
December 20th, 1900.

Refer also to "TOO LATE" *column, page* xviii

CAST-IRON STANCHIONS (24) Wanted, second-hand, 11 ft. 6 to 12 ft. long; also 24 10 by 4½ or nearest section rolled joist, 16 ft. long.—Send particulars and price to E. C. CHRISTMAS, Builder, Forest Hill.

WOOD WORKING MACHINERY

Of all kinds, and with

EVERY RECENT IMPROVEMENT,

Can be seen and tested in Trial Shops.

A LARGE STOCK FINISHED and READY FOR IMMEDIATE DELIVERY.

Call or Write for Catalogue.

SYDNEY BUTLER, Park Works, GLASSHOUSE STREET, Vauxhall, S.E.

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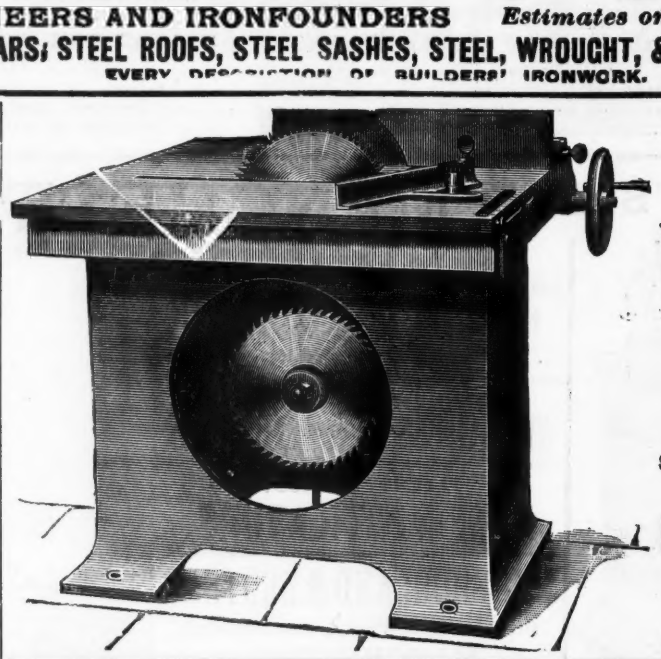

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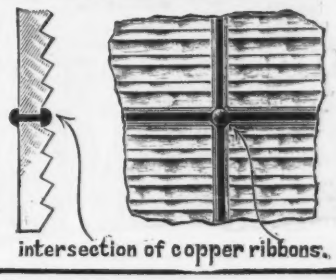

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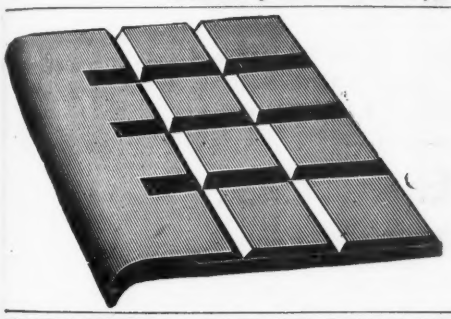

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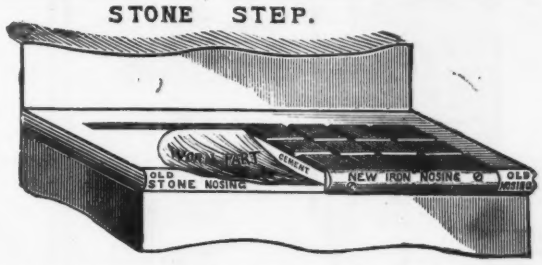

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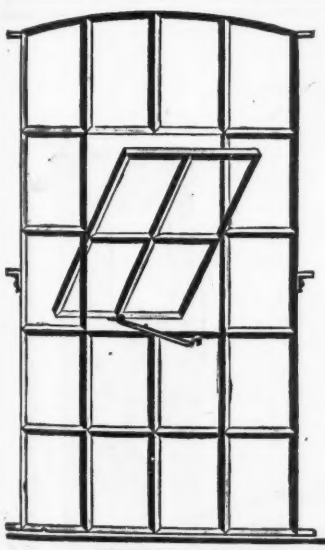

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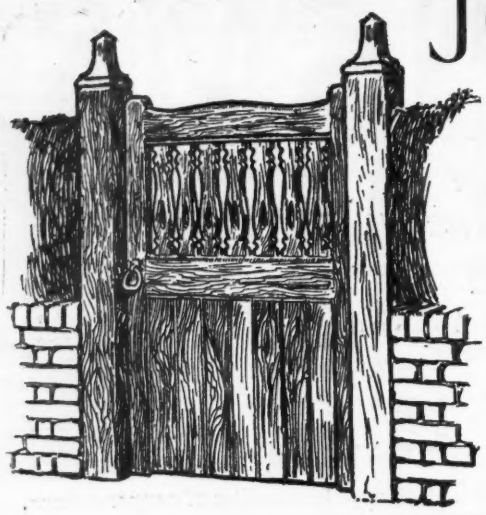

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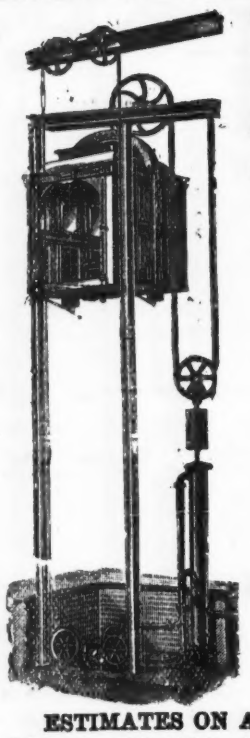

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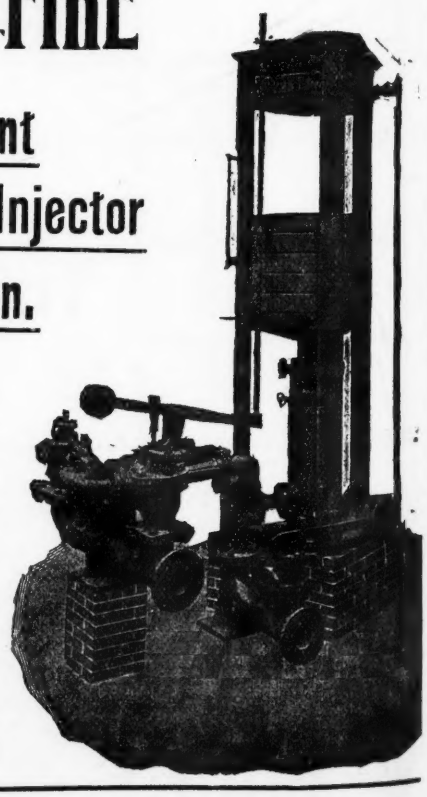

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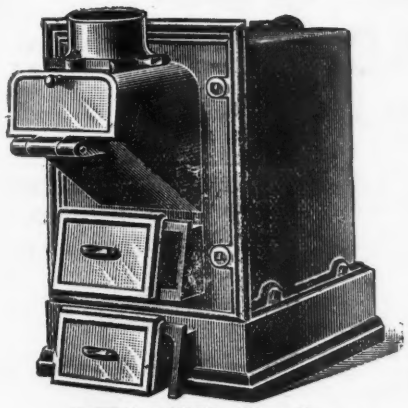
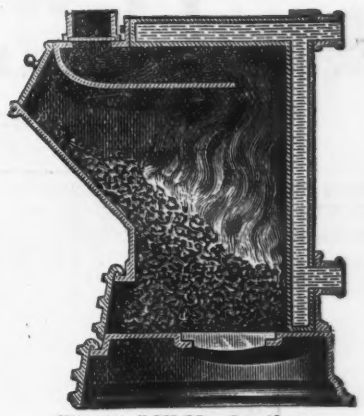


HANDY BOILER—Elevation.



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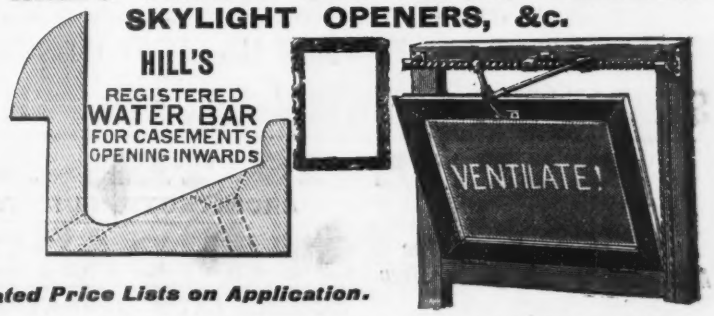

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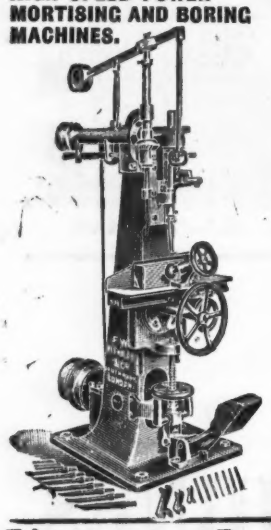

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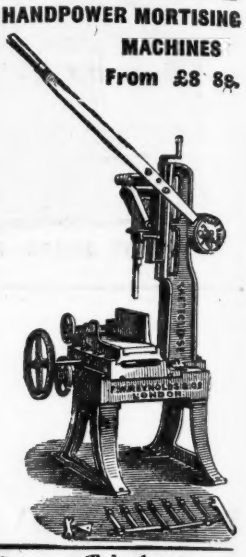

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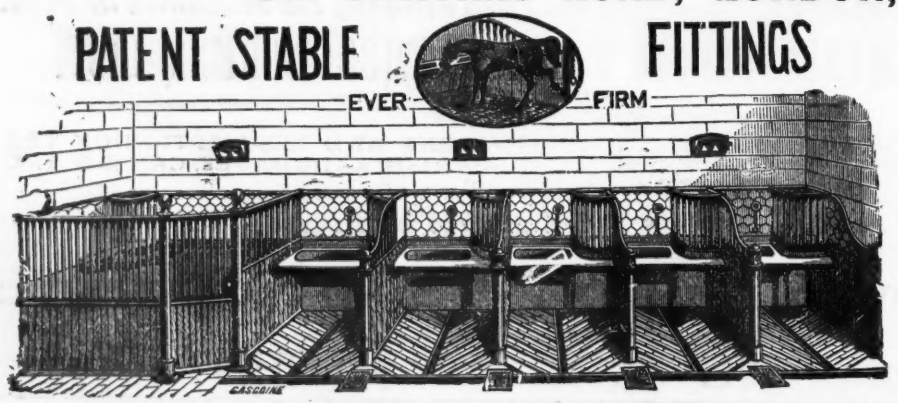

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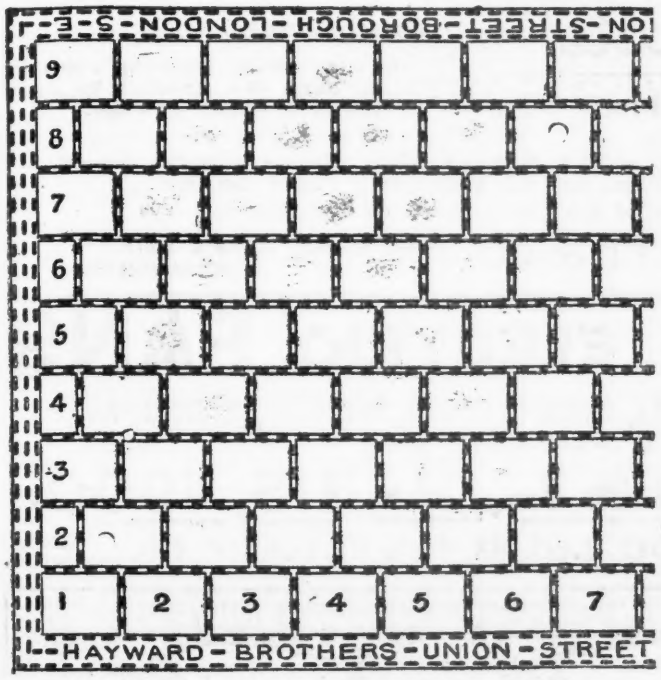

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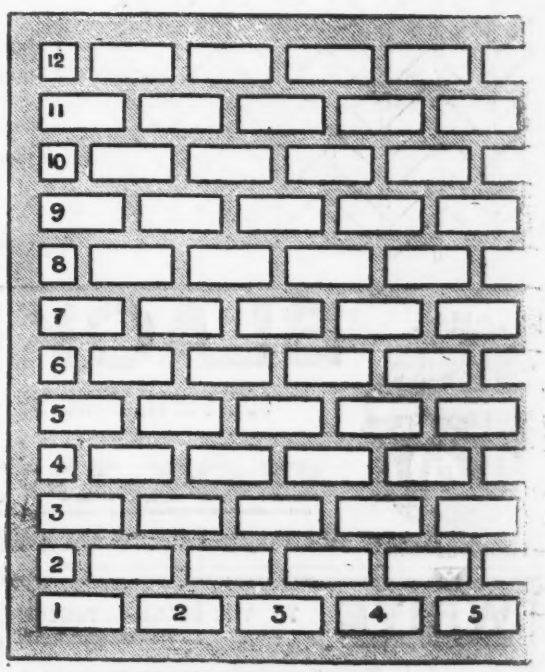

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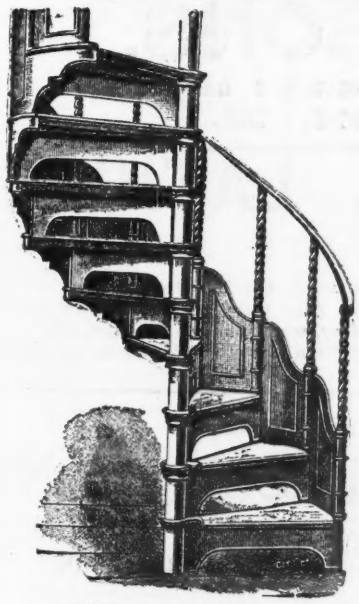

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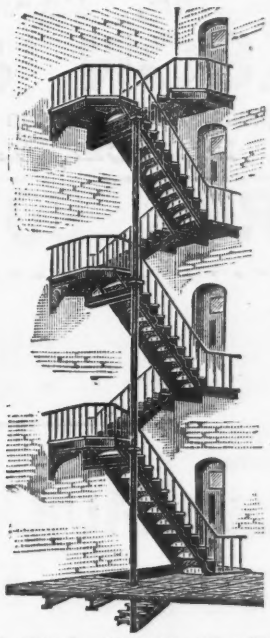

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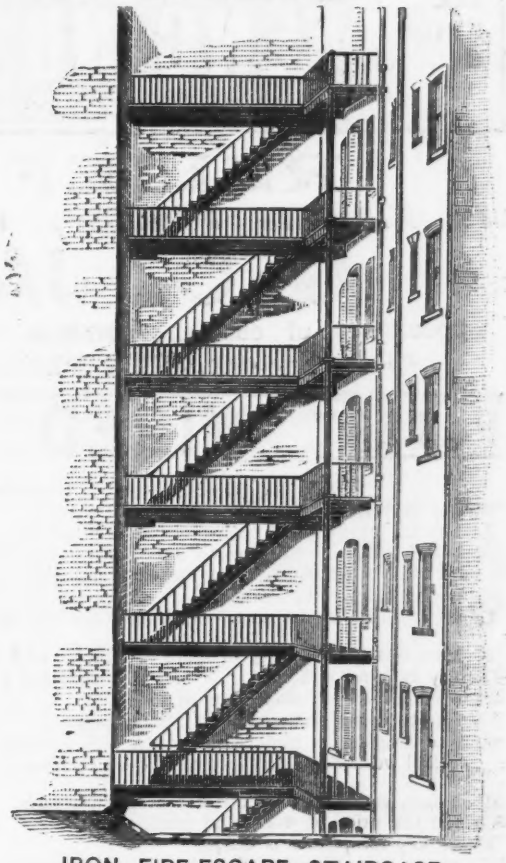

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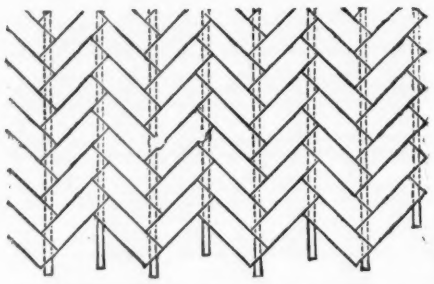

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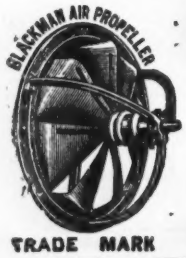

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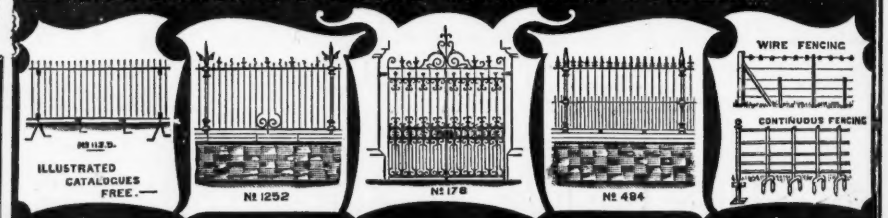

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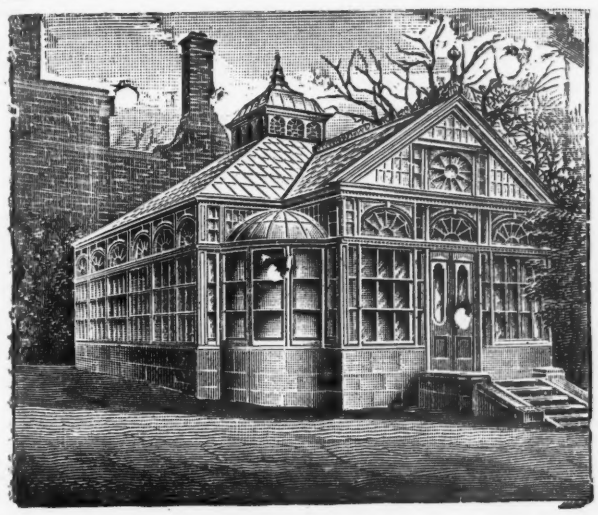

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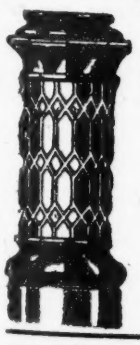

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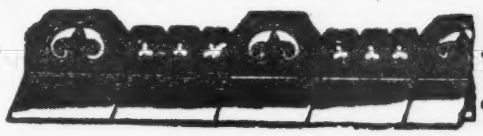

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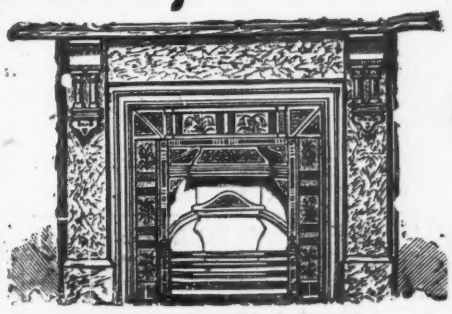

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Plans and specifications of the works may be seen, and any information obtained from Mr. CHARLES BOTTERILL, Surveyor.
The contractors are to attend personally or be represented at the Council meeting to deliver their own Tenders, together with a 10l. note and a schedule of prices, upon which the value of any extras or omissions shall be based, and to make a declaration that they pay the union rate of wages, observe such hours of labour as are generally accepted as fair in their trade, and that all unskilled labour shall be paid the minimum wage of sevenpence per hour.
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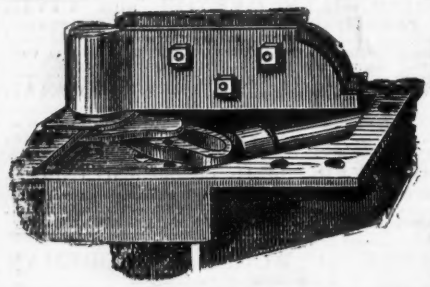

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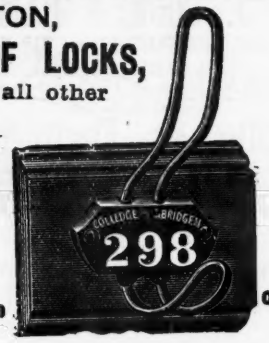

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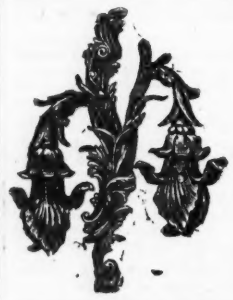

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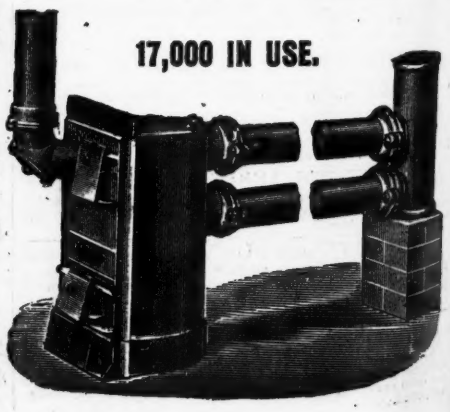

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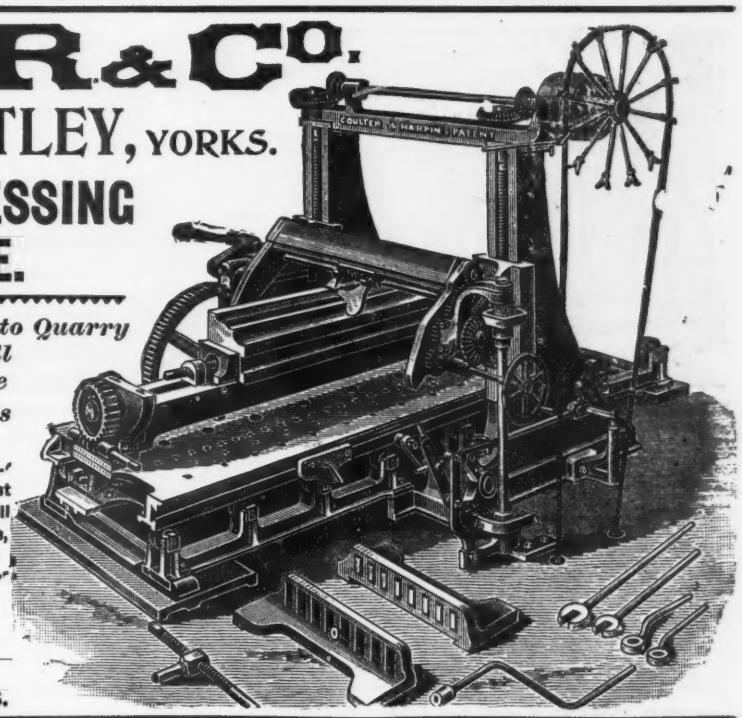

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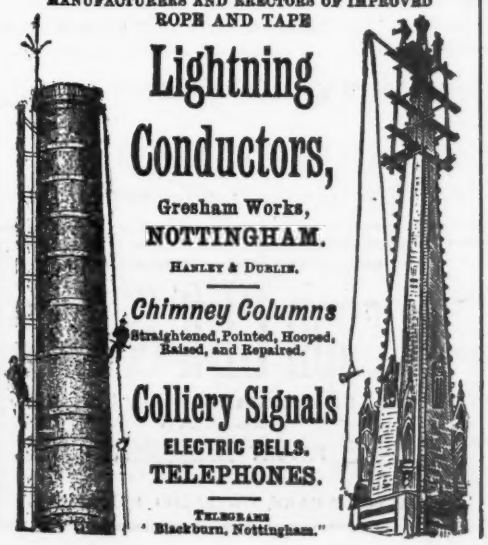

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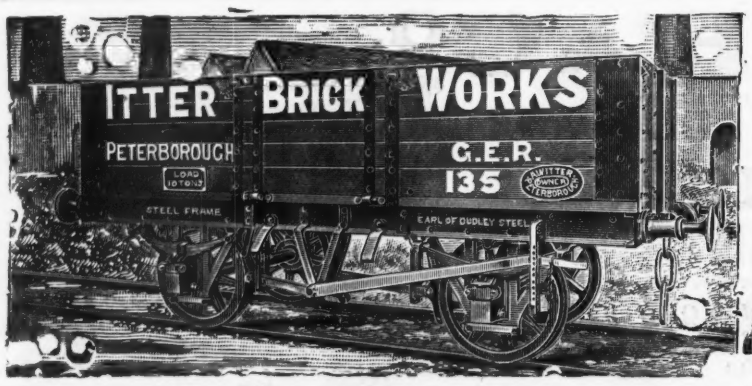

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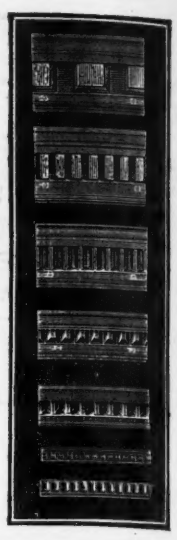

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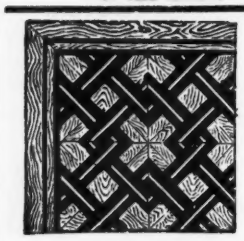

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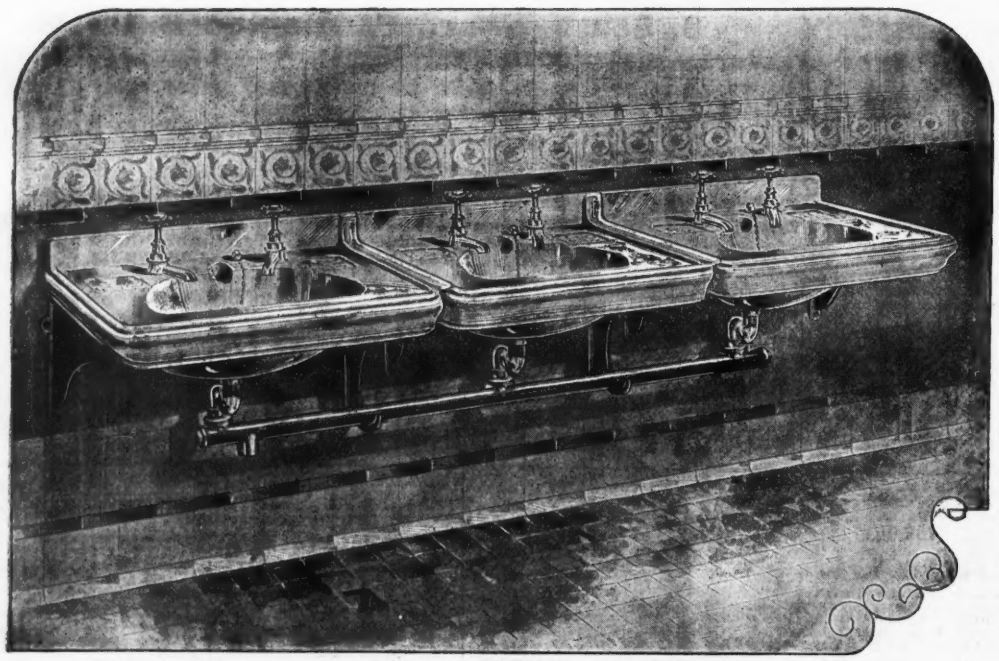

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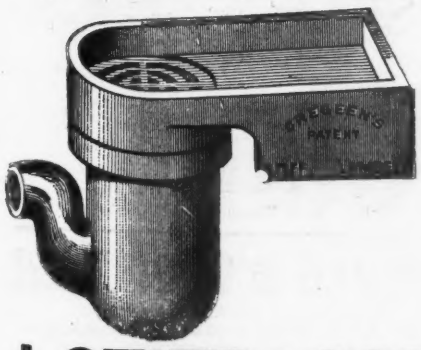

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Refer also to "TOO LATE" column, page xviii

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Dated this 10th December, 1900.

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Refer also to "TOO LATE" column, page xviii.

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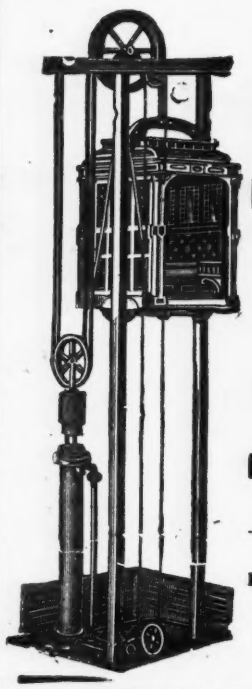

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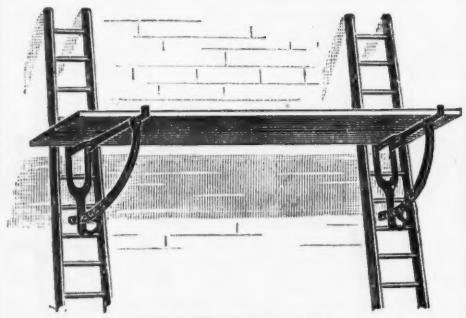

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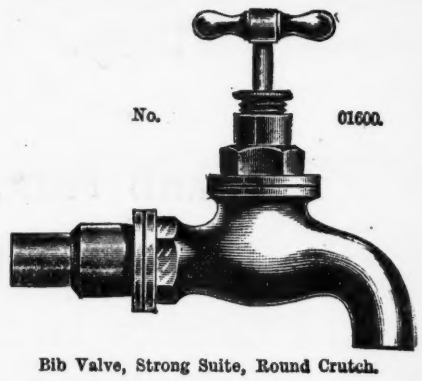

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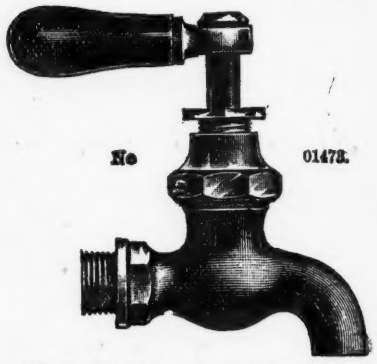
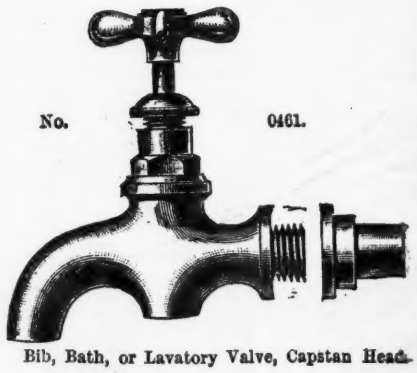


Bib or Bath Valve, ¼-turn Lever Handle.



Bib, Bath, or Lavatory Valve, Capstan Head.

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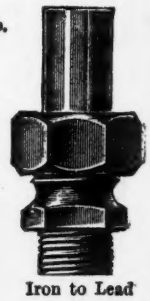

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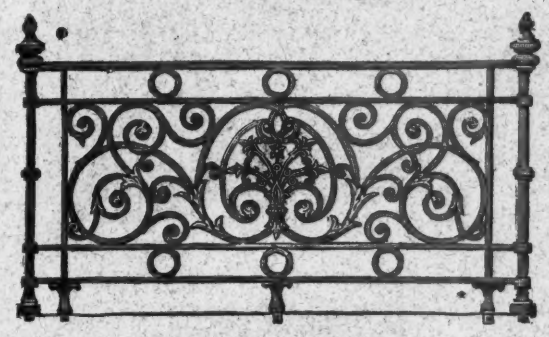

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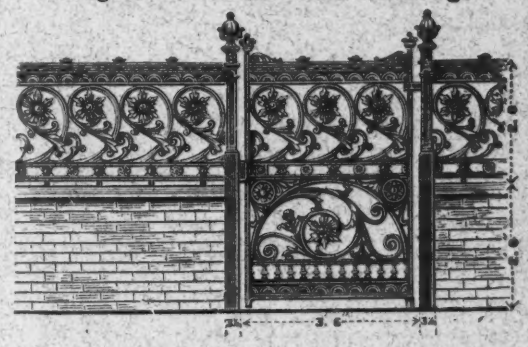

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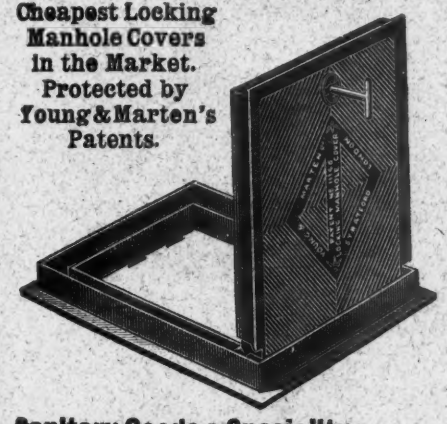

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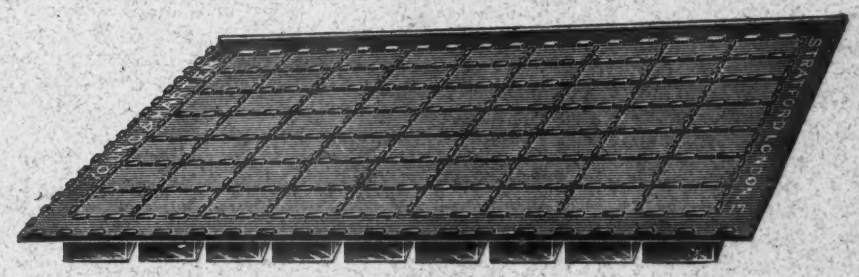

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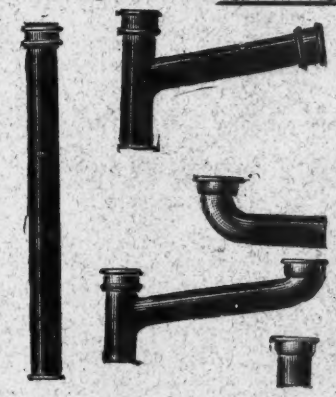

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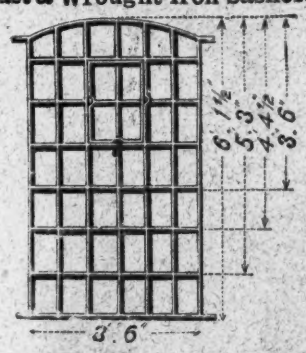

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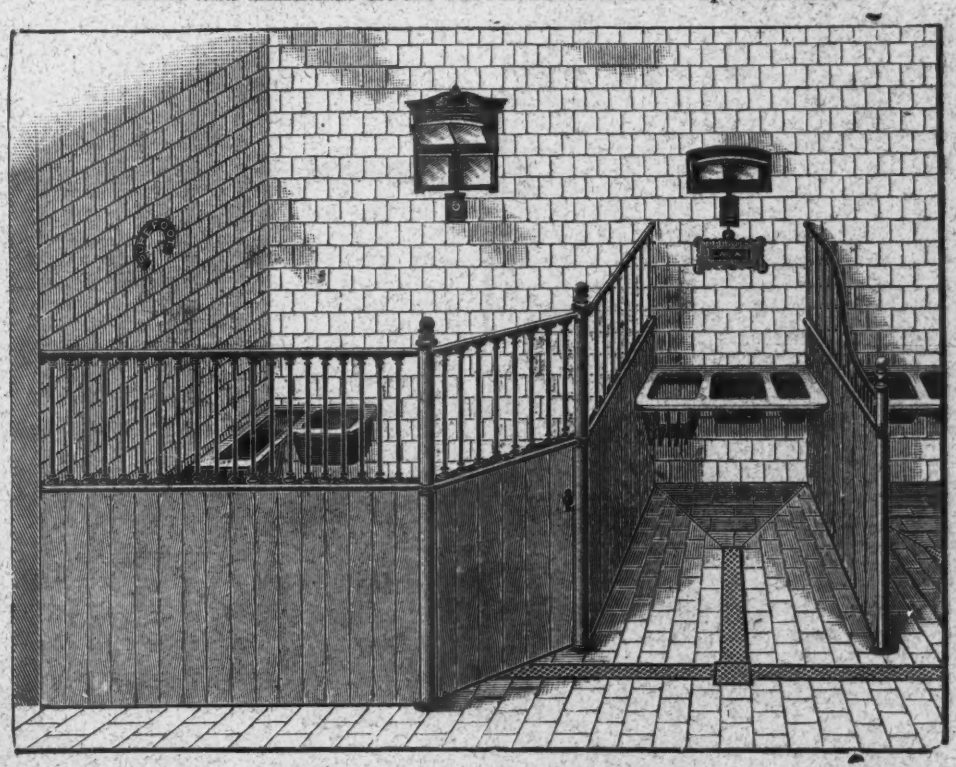

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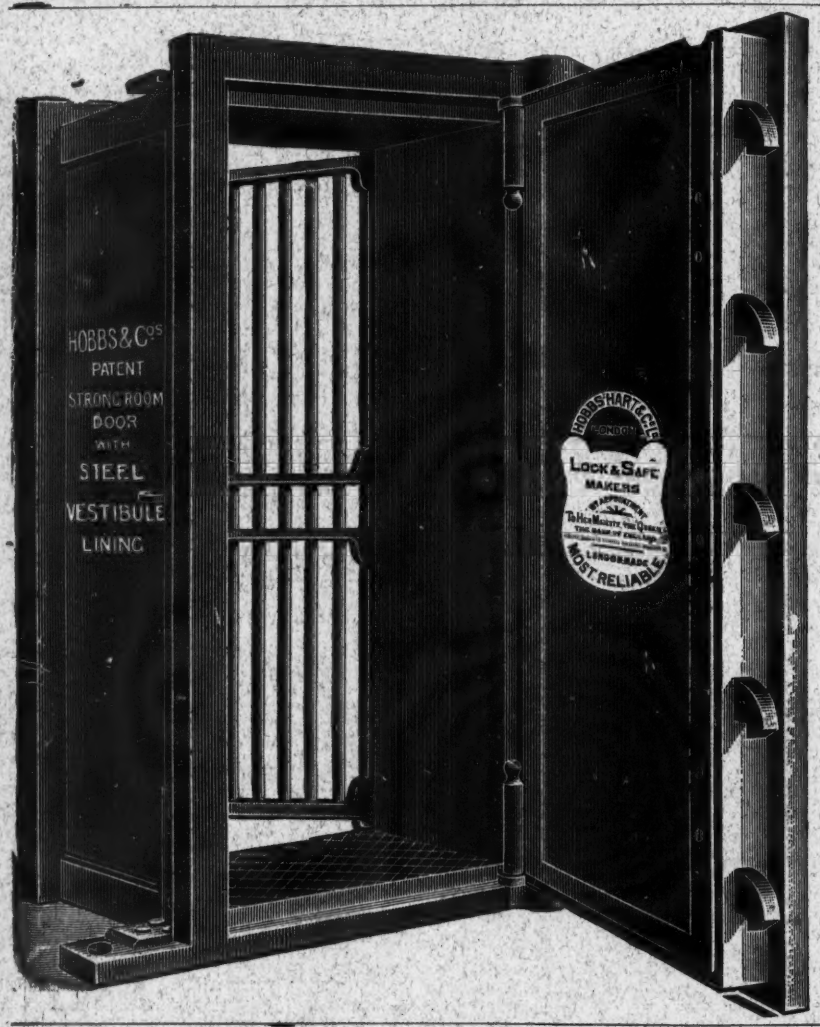

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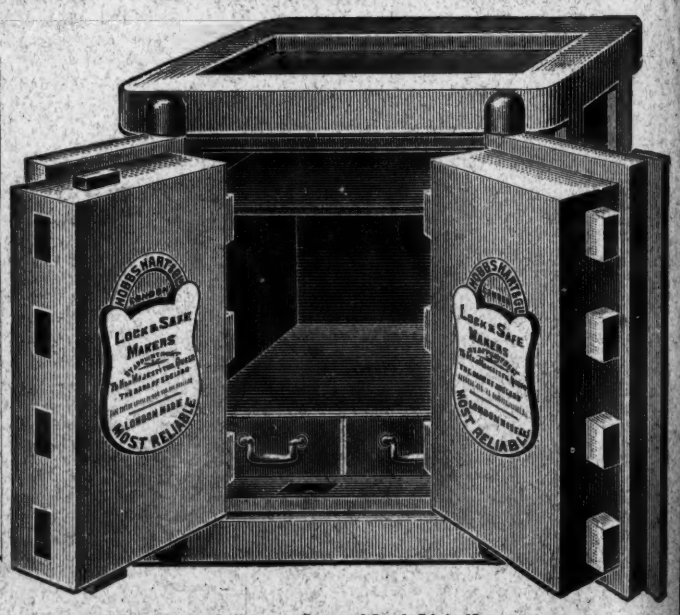

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